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GAS JOURNAL

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[Founded in 1849 as the "Journal of Gas Lighting."]

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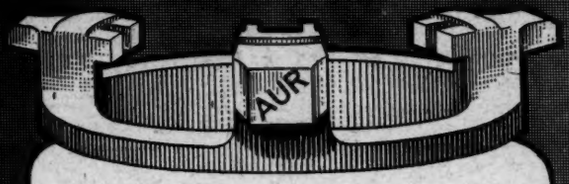

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VOL. CXLVII., No. 2935.] TUESDAY, AUGUST 12, 1919. [71ST YEAR.

EDITORIAL NOTES.

A Robust Protest by Mr. H. E. Jones.

THE announcement of the Directors of the South Metropolitan Gas Company that they accept "in its entirety" the original report of the Board of Fuel Research, and propose to apply to Parliament for power to give it effect in the case of that Company, has brought from Mr. H. E. Jones a vigorous protest, which is published in our "Correspondence" columns to-day. The letter only reached us as we were about to complete for press this issue of the "JOURNAL;" and we therefore can do little more here than direct attention to it. No individual has to-day greater right than Mr. Jones to speak his mind on questions of policy affecting the whole gas industry. Position and service justify him. In this case, his protest is not against the act of acceptance by the South Metropolitan Company of the report in substance and detail, as against the influence that *at the present time* the action may have in assisting to undermine the position that the industry has, through its National Gas Council, taken up in this matter—a position which is quite in accordance with the spirit of the report of the Board of Fuel Research, in desiring to confer upon gas undertakings greater liberty to help to conserve the coal resources of the country, and to deal still more broadly than under restriction it has been capable of doing hitherto, with the problem of fuel supply in the best manner possible. In regard to inerts and sulphur reduction, it has, as has been previously said, taken the South Metropolitan Company years to build-up its system and attain its present refinements; so that to-day, making only coal gas, it finds itself in the position—peculiar to itself—to comply in every detail with the report of Sir George Beilby and his colleagues. The gas industry generally cannot afford the time nor the money to place itself in the same position; and, if it could, Mr. Jones well expresses the feeling that is dominant throughout the gas profession when he says that the "restriction to so low a standard of "inerts and to sulphur limitation cannot be effected with- "out extra cost, which will represent more to the consumer "than they are worth." Liberty and elasticity are required in an industry dealing with such a large proportion of the country's chief raw material; refinements can be bought too dearly—not only to gas consumers, but to the country as a whole.

A more debateable subject is that of charging for gas on the heat unit basis. The change Mr. Jones opposes, and in doing so boldly strikes out. "Are we," he asks, "to substitute for "the well-valued and simple provision we are now making "of gas of about 480 B.Th.U. per cubic foot, at the lowest "price consistent with a dividend charge (seldom exceeding "6d. per 1000 c.ft.), a new-fangled fancy article at a fancy "price." The heat unit basis of charging does not depend upon the production of a fancy article. If there is anything in the proposed new basis of charging, it could be applied just as readily to the most economical gas that an undertaking can produce as to a "new-fangled, fancy" gas. It must be pointed out again, as it has been pointed out in these columns before, that this proposition to charge on the heat unit basis is part of the scheme for conferring liberty upon each undertaking to determine the calorific power which it can most economically supply, in place of a fixed standard imposed by Parliament for all undertakings. If there is a better way of getting Parliament to agree to the policy of "local option" in the matter of the thermal quality of gas supply than the one proposed, then let us see it; and it will be heartily welcome.

What Mr. Jones desires is liberty on the simplest lines; and in this he is voicing the feelings of the gas industry in almost every quarter. That liberty, tending to greater service, is not to be found in the condition of things against which he protests. Let him speak in his own words: "Since "my paper of 1902 to the former Institution of Gas Engi- "neers—in which I foreshadowed the gas of the future to "be a fuel of a cheap kind, capable of heating, power, and "lighting, at a low cost of production and of capital—I "have sought no other end; and I mean, for my own part, "to fight to the last for taking-off fetters, and for enlarging "the scope of usefulness by cheapening the production to "meet the man who wants services without waste or a "smoky chimney." Well spoken, and worthy of a man who was such an intimate friend of, and worked with, Livesey, who fought so long and strenuously for the technical and commercial liberation of the industry from the tyranny of unnecessary statutory restriction.

Co-Partnership and the Coal Industry.

THE intentions of the Government as to the nationalization or otherwise of the coal mines have been the subject of much speculative talk and prediction. At one time they were, according to the prophets, going to adopt the Sankey report, which is so much to the liking of Messrs. Smillie, Webb, Money, and Co. At other times, the report of Sir Arthur Duckham was to be the favoured one. Now the Parliamentary Correspondent of the "Daily Telegraph" says he "understands" that, while no scheme has yet been definitely approved, the Government will not adopt a policy of nationalization of the industry, and, after all, the Duckham report is unlikely to become the basis of the Government proposals. The manner in which the statement is made seems to mingle much positiveness with what the correspondent only "understands." However, it is interesting to learn that "there is reason to believe" (which is a cautious mode of journalistic expression) that provision will be made for a strengthened system of control, and that the Government will endeavour to give effect to the recommendations of the Coal Commission so as to invest the representatives of the workmen with a greater degree of responsibility in all matters affecting the safety of the men, their comfort and convenience, and the efficiency of working. Whatever is done, we sincerely hope that a component of the scheme will be some form of co-partnership, which would in itself supply adequate machinery for control, miners' representation in the management, and miners' investment in the capital and sharing in the profits. Nothing could be better. It is, in fact, a basic feature of the report of Sir Arthur Duckham; and it is the feature of an article by Mr. William Cash, F.C.A., the Chairman of the Bournemouth Gas and Water Company, in a recent issue of the "Evening Stand- "ard." The same thing has been advocated from time to time by Dr. Charles Carpenter as a palliative, if not a complete cure, for much of the unrest that there has been for some years in the coal industry. We seem to remember, too, Sir Corbet Woodall publicly expressing his belief that what had been found good in the gas industry should have similar effect in the coal industry. We are of the same belief, if practical means of application can be found.

The colliery owners themselves are quite agreeable to the miners having representation in the management. They are quite content, too, that they should have a dip in profits over certain levels; and that the owners should enjoy this privilege with them. But their idea leaves the consumer out in the cold; and this must not be. The miners' wages used to have a roughly regulated relation to the price of coal, while the colliery owners' profits were limited only by the amount at disposal. The consumers had then to sit

by, and see these interested partners enjoy the fruits of this pleasant arrangement, which gave the consumers no protection. A strong safeguard would be provided if the precedent that the gas industry offers were adopted, and could be practically applied. All those who have had experience of co-partnership in the gas industry, and have suggested a like scheme for the coal industry, apparently see no difficulty whatever in its application; and personally we also believe that, if all concerned only had the will, a way might be found.

But there are doubts following in the train of the belief. The scheme provides for a triple alliance, under which, as the price of the coal to the consumers goes down, the miners' wages and the colliery owners' dividends would increase, and *vice versâ*. We are under the impression that the miners would not be willing to adopt any machinery that operated upon their wages both ways. Be the times good or bad, they appear determined to hold fast to that which they have, and only to contemplate change by wages rising and hours declining. We have seen the effect in lower production of the reduction of the hours of work to seven; and yet increased production is essential to the reduction of the price of coal. There is the prospective curtailing of the hours to six; and therefore the probable further recession of production, and a higher cost per ton, which, under a scheme of co-partnership settled now, with the price of coal at the base, would mean that the men's wages and the colliery owners' profits would have to come down. What chance, therefore, is there of the miners to-day agreeing to a condition which makes their wages contingent on the price of coal to the consumers?

There is another difficulty; and it is an important practical one in the construction of the details of the triple co-partnership. A standard selling price would have to be fixed. Mr. Cash speaks of its fixing as though it would entail no trouble. He suggests that it would have to be determined for each colliery by an authority created for the purpose. That a tribunal would have to be set up for this express purpose points to the difficulty of the problem. But, says Mr. Cash, with a principle established, the detailed calculations would follow. So that with a principle established only detailed arithmetic would be needed. For this an *ad hoc* authority ought not to be necessary. Nevertheless, one would be; and a very expert one too. We should not envy them their task. A standard price would have to be fixed for "each" colliery. Some colliery companies possess several collieries; and so would have several standard prices with which to deal. We can see complication there, and complication that might lead to trouble with the men at the different collieries (under one ownership) with different standard prices. Then from the same pit there come different grades of coal, selling at different prices, and there is not uniformity from time to time in the output of these different grades of coal. In such circumstances, it is difficult to appreciate how one fixed standard price could be found that would apply.

These and other matters require discussion before the Government definitely adopt co-partnership in the coal industry as a means of establishing contentment where discontent has so persistently reigned. We hope a way will be found for applying the system; but it would be folly to refuse to recognize difficulties that jut out from the midst of a generous desire to legislate for something better than has obtained in the past.

Power on the Gas-Works.

FUEL economy has brought very largely to the front the subject of the provision of power. It has been introduced lately before various societies—engineering and otherwise—with a frequency which defies one keeping well in pace with all that is advanced concerning it. However, out of the mass of discussion and investigation by engineers of experience in different industries, there consistently emerges the fact that for power purposes, in respect of fuel economy, the gas-engine stands remarkably well, though, of course, fuel economy is not the only matter for consideration. But it is so that, thermally considered, the gas-engine can for continuous purposes give a B.H.P.-hour with a fuel economy and cost which will bear comparison with its competitors. Sir Dugald Clerk may be singled-out as having supplied quite recently figures which prove the fact. There are, however, other matters to take into account; and it is only when one gets complete information as to the purpose or purposes for which power is required, and running conditions, that final determination can be made as to the type of power plant that it is best to adopt. Every set of conditions should be dealt with on its merits. If this is not recognized, then the engineer is old-fashioned and prejudiced; and the sooner he proves himself neither the one nor the other, the better for him and his place in this fast-moving world. The gas engineer especially should take a very broad outlook upon this power question. He must not be wedded to the gas-engine, for he has his coke for sale for steam raising. He must not be opposed to the electric drive, for he finds it a convenience in his peculiar circumstances. And he has gas-engines which can be utilized for generating electric energy, and coke for raising steam which can be put to the same use. He has a big power field before him for his wares; and the gas of the future, and the proposed elasticity of gas-producing operations, should cause him to breathe and move more freely in that field. The gas engineer will show good strategy who captures a large share of the power business before the reorganization of the electricity supply industry strengthens its power situation.

As early as possible, the gas engineer should begin a power campaign by setting his own house in order in regard to power. Some of the most disgraceful instances of power provision are to be found on gas-works, and some of the most approved. On gas-works, there are gas-engine and electric-motor installations that are beyond criticism; but often steam-engines are found that are a reproach to an engineer who preaches, and prides himself on, economy. This is not a good advertisement where gas officials want to show what a steam plant can do run on coke or coke breeze, with boilers properly equipped for the purpose. The maintenance of old steam-power relics about a gas-works is, as Mr. H. C. Widlake last week pointed out in the first of a series of articles on "Gas-Works Power Plant," no doubt due to the quantity of fuel on such works that was at one time looked upon as being low grade and practically waste. The times have now changed; and all fuel has permanently increased in value, and every economy is to-day worth more than before. The so-called "waste fuel" has a marketable value. For economy's sake, then, old uneconomical steam-raising plants and engines that, figuratively speaking, eat steam should be discarded as early as possible; and where steam in large volume is required for other purposes, it may continue to receive favourable consideration, if the conditions permit, for power purposes, though even then there may be other superior reasons for giving preference to the gas-engine or the electric motor.

The whole intention of Mr. Widlake's articles is to discuss the problem of, and advance considerations affecting, judicious modernization of power plants. And the judiciousness is not limited to simply replacing antiquity in the way of steam plant by modernity in the same line, or by disestablishing steam and installing a gas-engine, or using for driving a dynamo one or other of the prime movers only according to the dictates of predilection. Fuel, load (including the respective claims of the steam and electricity generating plants), time, convenience, capital, labour, and other factors, including over-all economy and efficiency, have to be taken into account. A very special survey requires to be made in order to ascertain that the maximum economy is obtained from the total of the power plant, so as to eradicate waste. In this connection we are reminded of the charges made by Mr. Widlake as to steam-plant inefficiency, which to one brought up in a works run on modern lines will appear extraordinary. Just imagine steam-engines, though of the simple non-condensing type, consuming 100 to 120 lbs. of steam per B.H.P.-hour, and requiring something like 24 lbs. of fuel, while modern non-condensing engines can be obtained consuming not more than 30 lbs. of steam per B.H.P.-hour, with a fuel consumption of 5 lbs.; and theoretically the steam consumption would decrease by fairly large strides with the rise of pressure. Of course, these are not the modern high-class engines for larger powers which can now be obtained to give 1 H.P.-hour for (say) 10 lbs. of steam, and with high efficiency boilers which have recently been tested will give the quantity of steam for 1·26 lbs. of fuel per H.P. hour. It is just as well for gas engineers to keep in mind the fact that, though these are not the types of engines with which they have ordinarily to compete with town-gas engines or require themselves, their oldest power competitor has not been standing still, but has been making improvement all along the line.

There is a point about the gas-engine that is worth re-

membering in making changes. The modern gas-engine is, of course, mechanically a far superior machine to its forerunners. Its thermal efficiency is somewhat better, and is in advance of the steam-engine and the electric-motor. But Mr. Widlake points out what is a fact that, given proper supervision and adjustment, the efficiency of some quite ancient gas-engines is well maintained, and still gives little trouble. But in considering the replacing of old steam or gas engines on a works with the variety of mechanically operated plant such as is needed in the processes of gas manufacture, due consideration must be given to the laying down of a system of electric power transmission (the energy being generated on the works) as compared with the direct drive. In this connection, it is highly important that efficient generation should be accompanied by efficient utilization; and in this respect an article written by Mr. E. Davis, of Beckton, dealing with the care of retort-house electrical plant, will be of interest, and supplement what Mr. Widlake will have to say.

Quite sufficient has been said to show the scope the gas engineer has in providing power on his works, which might supply object-lessons for manufacturers generally. Having this scope, the importance of such articles as those we are now publishing is not in the slightest overrated by this comment.

Direct Sulphate Process and Ammonia Losses in Oxide Purifiers.

FOR the fourth year in succession, Mr. W. S. Curphey has devoted part of his annual report, as Chief Inspector under the Alkali Works Regulation Act, to a consideration of the low ammonia efficiency of some of the direct-process plants for sulphate of ammonia making; and, in association, purifier working has been under investigation. This has established serious ammonia losses at the purifiers, which has prompted research into the conditions necessary for realizing the highest purification efficiency. The research, which has been very largely in the hands of Mr. Linder, with the hearty co-operation of the engineers of the works concerned, has been instrumental in defining the conditions which contribute to greater efficiency in both purifiers and the direct process sulphate plant. The conclusions and suggestions made in previous reports are briefly summarized in the present one; and there is also, in the results of the new investigations, confirmation as to the accuracy of the prior conclusions. Quite apart from the question of the direct system of sulphate of ammonia making, there is every reason to-day, with the changes that are proceeding in gas making and the deprivation of gas of the heavy hydrocarbons through oil-washing for benzol, why there should be complete scientific control of the purifiers. In their reports to the Institution of Gas Engineers on the destruction of meter parts and corrosive action in mains and services, Messrs. Taplay and Parkinson have shown how the production of corrosive properties has been due to the reaction of carbon bisulphide with ammonia, and how the interaction of these constituents has been more energetic since the removal of benzol from the gas. Their corrective is the atomizing of paraffin oil in the gas, and, where necessary, the oil-spraying of meter mechanisms. This shows that, for protective purposes on the district, the ideal condition would be for no ammonia to pass the purifiers; and therefore the lower the amount of ammonia required to maintain the purifiers in working condition the better.

With the direct system of sulphate making, there are considerable losses of ammonia, part of which could be largely prevented if more attention were paid, while distilling the virgin liquor, to the due adjustment of the lime and liquor feeds. The ammonia content of the virgin liquor is by no means a constant quantity, nor is the quality of lime always beyond reproach. Moreover, as Mr. Curphey points out, the advantage of a continuous lime-feed is insufficiently appreciated even at works where the scale of operations would fully justify its adoption. Given proper control, the amount of ammonia lost is considerably reduced. The investigators are also satisfied by their researches that, using the backward rotation system of purifiers, with downward flow, less ammonia is needed to maintain the working efficiency of the oxide; a better distribution of ammonia is secured in the boxes; the condensed water descending with the gas carries with it any dissolved ammonia in excess of that required to neutralize ferrous sulphate in the upper layers; and with the change of the position of purifiers in the rotation, any ammonia retained in the oxide is utilized in the new positions. Take "Works E" mentioned in the report. Since the manager adopted the suggestions contained in the Chief Inspector's previous reports, and has converted his purifiers to the backward rotation system with downward flow, he has found that, whereas formerly in the winter months 15 to 20 grains of ammonia per 100 c.ft. of gas were necessary to maintain the purifiers in working condition and 2 to 3 grains in the summer months, tests now show that 1½ to 5 grains suffice. This is highly satisfactory; and further ammonia economy is assured by the condensed liquor from the purifiers and connections being returned to the scrubbing system. Since 1915, during which period there has been a gradual change in the mode of operation of the sulphate plant, together with the adoption of the backward rotation purifier system and downward flow, there has been an increase in the sulphate of ammonia yield per ton of coal from 18·5 lbs. to 24 lbs., and the number of purifiers changed per annum has been reduced from 26 to 10. This is good testimony. It shows three things—that in comparatively small works (according to the coal used) good sulphate of ammonia results can be secured by the direct process, as well as excellent purification results, and a considerable saving of labour. In the present report will be found mention of other advantages which accompany the adoption of the backward rotation purifier system and downward flow, and which help to reduce purifier changes and to promote general efficiency.

A Paisley Scandal.

WE have hardly patience to touch upon a state of affairs which exists in Paisley to-day. It might have inspired Gilbert and Sullivan; and they could no doubt have made it the foundation for a splendid piece of burlesque. But to us what is happening there is something that is nothing short of scandalous, and a blot on the business fame and sense of justice of the men composing the Town Council. The gas undertaking has its hard times—peculiarly hard just at present; and so have the consumers of gas. In these or any other circumstances, what possible fairness can there be in making the gas consumers pay something like two-thirds of the heavy loss last year and estimated in the current one upon the electricity undertaking, and the electricity consumers only about one-third? This is what is actually proposed; and, from our way of thinking, the gas consumers of Paisley are simply being robbed of 9d. per 1000 c.ft. in order to pay the costs of supplying those people who prefer to use electricity. The electricity consumers ought to feel as highly indignant over being asked to take charity from the gas consumers, as the gas consumers must be at being compelled to find the money to square the electricity accounts.

The facts are simply these: It is estimated by Treasurer J. A. D. M'Kean that, under present conditions, there would be at the end of the current year a deficiency of £14,436 on the gas undertaking, from which there is £3535 profit from last year to be subtracted—leaving £10,900 to be made up by an increase in the price of gas, for which about 6d. per 1000 c.ft. would suffice. The electricity concern had a balance on the wrong side last year of £13,478; and it is calculated that the loss this year will be £11,341—the two amounts making together £24,819. But it is only proposed to raise the price of electricity sufficiently to bring in £9567; and it is open to doubt whether part of this will be realized. Therefore, to make up the estimated deficiency on the gas undertaking (£10,900) and the estimated deficiency on electricity (£15,252), the gas consumers are to be compelled to pay 1s. 3d. more per 1000 c.ft. Were we among the gas consumers, there would be very strong protest against this piece of inequality and iniquity.

It is avowed by Treasurer M'Kean that, if more is put on electricity, it will kill the trade in it. How does he know that? Has it been tried? Or is the assertion only surmise? The logical conclusion from his statement is that the price of gas can be raised to the (for Paisley) heavy figure of 5s. 5d. without harmful effect upon the gas business. Thus for the support of the one, the other must be called upon to subsidize it. We do not believe in subsidies. The system is economically wrong and unsound; and the consumers of every commodity should be called upon to pay a price which fairly—not unfairly—covers the cost of supplying them. The price which is now going to be charged for electricity for private lighting may be the maxi-

mum; the prices for other purposes are not. And as to the price for private electric lighting, it is within the power of the Council, if the maximum has been reached, to apply to the Secretary for Scotland for its increase. According to the electrical theory, electricity has so many merits and advantages that (assuming the theory is correct) the current ought to stand any price that equals the total cost of its provision at the terminals of consumers. But apparently Treasurer M'Kean and his colleagues regard the theory as illusory. Nevertheless, if it is necessary to trade in electricity at below overall cost price (a proposition with the righteousness of which we do not agree), then the losses should be passed on to the whole body of ratepayers, and not on to that section who prefer the use of gas to electricity. At the same time, we should not like it to be thought that Treasurer M'Kean does not sympathize with the gas consumers. He does, and, in his opinion, it would have been better for them and Paisley generally if there had never been any speculation by the Council in electricity. But sympathy and opinion do not clear away our point that it is a scandalous state of things that allows the loss on the electricity undertaking to be dumped on to the gas consumers in the way proposed.

Changes

We are in these times getting accustomed to vast changes in the gas industry. This month a change that has been slowly growing will be more pronounced, both in our news and advertisement columns. For much over a century now, the gas industry has been making history; and as long as living men in the industry can remember, there have, with the majority of its companies, been two general meetings of the stock and share holders in a year. A minority has never held anything but annual meetings. There have been advantages and disadvantages in the half-yearly meetings; the principal disadvantage (which increases with time and development in the character of business) being that the two halves of a gas year have little in common. Hence it has always been necessary to make comparison with the corresponding half of the preceding year to show the movements of the business. But this does not take into consideration the influences of the six months between the two periods. We are in full sympathy with those stock and share holders who desire to meet a Board of Directors at more frequent intervals than twelve months, and hear how things are going. But this sympathy is completely overbalanced by the very practical arguments that are brought to bear in favour of the annual meetings. The banks and the railway companies led the way in changing from half-yearly to annual meetings. Then gas companies made a start in the same direction, with the result that, so far as the Metropolitan area is concerned, we have in the last August or two been missing the announcements and reports of meetings of the Gas Light and Coke and the Brentford Companies.

And their Progress.

Now this August we shall miss from our pages the announcements and reports of the proceedings at meetings of the Commercial, South Suburban, and Tottenham Companies. As a matter of fact up to last Tuesday, though there had been various notices of the closing of transfer books, only one notice of a meeting of a London Company had been published—that of the South Metropolitan Gas Company. Then the Hornsey and Barnet Companies broke the silence. Other companies, as time passes, will no doubt fall into line, until the annual meeting becomes the general fashion. Editorially, we shall not miss these meetings the same as we might have done in the days when things were more or less in a rut in the industry. Now the industry is omniactive. There are so many organizations, so many meetings to be reported, so many problems engaging the attention of the industry, so many new topics, and so much from outside the industry that now brings pressure to bear upon its affairs, that the trouble (if so it can be called) is that, far from there being any dearth of matter, the plethoric state grows worse, and it is necessary to make closer selection according to the importance of the subject. At the same time, the "Journal" does not economize merely for economy's sake. No matter that has importance—current or permanent—for the gas industry is refused the fullest possible record and discussion, and therefore circulation throughout the gas profession.

Coal and Folly.

While the country and the whole of Europe are struggling with a great coal shortage, the Yorkshire miners are suffering from misdirection, and deliberately adding to the misery of the position. They are out for something that is infinitesimal; they are losing wages and frittering away funds for this purpose at a rate which must soon produce exhaustion, and which the gain of the points for which they are out would not yield any reasonable compensation. A large part of the miners do not like the situation; but, in their foolishness, they talk of the necessity of being loyal to their Union, as though the country itself has no prior claim upon them to be loyal to it. If the truth were known, it would probably be found, too, that the Yorkshire miners' leaders are not feeling altogether comfortable over the ebbing financial strength of the Union; but with such leaders personal dignity and points of so-called "principle" count for much. They are afraid of what they might personally lose if defeat is the issue of the stupid attitude they advised should be taken up. So it comes about that conference after conference ends abortively; the last one in London on Friday, on which hope was strongly built, coming to the same end as all previous ones. Not a single step was made towards settlement.

Effects upon the Coal Situation.

Yorkshire produces about 17 p.ct. of the whole coal output of the country; and it is estimated that through this and other unofficial strikes during the past three weeks, the coal supplies of the country have suffered to the tune of 3 million tons. Besides this, the attempt to keep the public services of Yorkshire supplied, has meant a large disorganization of coal distribution in other parts of the country. Yorkshire industries are in serious straits; and the tale of unemployment is daily growing larger. In some districts food is reported to be scarce; and special steps are being taken to prevent starvation. Next winter we shall feel what is now being done much more acutely than now—gas undertakings drawing supplies from Yorkshire among the rest. The coal provision that was being made for the winter is being tapped more and more as the evenings shorten and a larger measure of artificial light is required. The loss to the country will be colossal; and the country will not forget to whom this is due. It is not a question of shortage of wagons or tubs; there is nothing but sheer obstinacy in declining to accept an agreement made by the Government and the Miners' Federation. In respect of coal, there will be no assistance for us next winter from other countries; they want help from us, and will not be able to get it. The position to-day is unpleasant; the outlook is far worse.

Invention and Discrimination.

The Patents and Designs Bill which is now before Parliament has aroused the hoary subjects of patent protection, the duty of the country to the inventor, and such-like matters, and discussion has been rife. An inventor is an asset to the country, and should be heartily encouraged. But there are such a large number of those who are described as inventors who should be just as heartily discouraged. Indeed, a very big block of the patents taken out annually are not worth the paper their description occupies; and there seems little difficulty on the part of such "inventors" to provide the necessary fees. What is wanted is better encouragement for those who may discover or produce something positively good, that will promote industry and public advantage, and so be a good thing for the country at large. If Parliament could only find the means to give encouragement where it is due, and discouragement where it is required, an excellent piece of work would be accomplished. The Bill now before Parliament is regarded differently according to the course of consideration given to its provisions. For our part, we see in the Bill an essay to redress some of the items in the long catalogue of wrongs that could be compiled from what has been said and written by the numerous assailants of our patent laws.

Main Objects of the Bill.

From the point of view of real invention, however, the new Bill metes out beggarly treatment; from the point of view of some of the rubbish misnamed invention, it goes farther than the need. There has been much complaint as to the time lost by inventors owing to the war, during which time their patents have

been inoperative. The Bill extends protection from fourteen to sixteen years in all. This is better than nothing; but to those inventors who have really something good, two years is trivial compensation for what practically amounts to five years' cancellation. Inventors who have something of genuine worth, but are without capital, deserve consideration; and something is being done for them in the Bill. They are generally, because of their poverty, the prey of men who have the faculty of growing rich and living on the fat of the land at the expense of other people. Against them real inventors require practical protection. Their case is a hard one; but a very strict discrimination is necessary, as there are so many who think they have something that is destined to be world revolutionizing which is utterly impracticable or useless. Then this country has had to put up with much hocus pocus on the part of foreign inventors; and the Bill proposes to counter the abuse to which we have been subjected by patents being taken out by aliens, the goods made abroad and imported here, but never manufactured here on a commercial scale. This is to be altered. In all these matters inventors, industry, and the country should be considered together; but there is a proneness to look at the question almost solely from the inventor's point of view. There are still lots of troubles that the critics require rectifying—such as the date of the protection running from the time a patent is granted and not from the time application is made, and a substantial reduction of fees. But in these times the Government are naturally loth to let slip any of their revenue.

THE PRESENTATION TO MR. SHOUBRIDGE.

THE retirement after twenty-two years' service of Mr. S. Y. Shoubridge proved to be an incident which disturbed the comradeship at the South Suburban Gas Company's works, Lower Sydenham; and the employees, with one accord, felt it an honour to be associated with the farewell presentation made last Saturday week to this distinguished engineer on his well-earned retirement. Readers will have seen on p. 283 of the "JOURNAL" dated the 5th inst. the photograph of the illuminated address and other beautiful gifts of which the presentation consisted.

Mr. and Mrs. Shoubridge were the guests at a representative gathering, in the Livesey Memorial Hall.

Mr. W. G. WALLER (the employees' representative on the Board of Directors) stated that they had met there to ask Mr. Shoubridge to accept a souvenir, as a mark of their esteem. They all owed a debt of gratitude to Mr. Shoubridge for the splendid example he had always set them in his devotion to duty and in his great endeavour to perfect their splendid co-partnership. The scheme stood out above all other schemes, and as the best yet evolved as a solution of the problems of Labour and Capital.

Amid applause Mr. Shoubridge then stepped forward and received the testimonial, which included a massive silver oval centre-piece, in the shape of a bowl, measuring 15 in., beautifully chased with floral decorations, and finely modelled handles in the form of pairs of wings. It is supported by four feet, and stands on an ebonized plinth. On each side of the centre-piece is a plain shield, one of which is engraved with the monogram "S. Y. S.," and the other with the full inscription: "Presented to Sydney Yarrel Shoubridge, Esq., by the employees of the South Suburban Gas Company, on his retirement, June, 1919." There were also a pair of vases and an artistically designed illuminated address, which was as follows:

SYDNEY YARRELL SHOUBRIDGE, ESQ.,
Chief Engineer,
South Suburban Gas Company,
Lower Sydenham, S.E.

Dear Sir,—It is with feelings of respect that we approach you on the eve of your retirement to bid you farewell.

During the twenty-two years' service as Chief Engineer, you have always shown us a deep sense of duty and discipline, and have won our respect by efficient and conscientious administration.

We ask you to accept, as a token of our respect, a silver centre-piece; and in wishing you many happy years in your retirement, we beg to subscribe ourselves, on behalf of the employees,

B. P. BEZANT, A. J. COLE, E. G. DICKINSON, H. A. FLOAT, H. G. GLASS, FREDK. G. GORMAN, W. GOSLING, W. M. JUDD, E. L. A. MOYCE, and W. G. WALLER.

Mr. SHOUBRIDGE, in returning thanks, recalled that there were some with them that day who were present 22 years ago in the old Recreation Room, and heard him express his desire to win the respect and esteem of all those with whom he had to work. Sir George (then Mr.) Livesey introduced him on that occasion; but he, and all his co-Directors of that time, had since gone to a happier region, where they were looking forward to meeting them again. During almost a quarter-of-a-century he had been connected with the Company. The old Crystal Palace District Gas Company had become a great and important one, known as the South Suburban Gas Company, with boundaries extending from Gravesend to Sevenoaks; and in order to cope with this development, great extensions had had to be made in the plant and distributing system. He should ever be grateful to the Directors for the help and encouragement given him, and to all the employees who had worked with him so ungrudgingly. Referring to the co-partnership system, he said it was now acknowledged as the only remedy for the great industrial unrest which was disturbing the world to-day.

Cheers were given for Mr. and Mrs. Shoubridge; and Mr. F. G. GORMAN (Deputy Engineer), Mr. A. J. COLE, Mr. S. B. CHANDLER, and Mr. E. G. DICKINSON all testified to the real pleasure it had been to work with so honourable a gentleman, whose fame as an engineer, said Mr. Gorman, extended throughout the world.

PERSONAL.

Mr. THOMAS LAW, of Sowerby Bridge, has been appointed Assistant Secretary and Manager to the Malton Gas Company.

Mr. P. J. ROONEY, the Manager of the Newbridge (co. Kildare) Gas-Works, has left to take charge of the Strabane Gas-Works, and is succeeded by Mr. J. A. ROONEY.

Mr. A. M. KEILLOR, Gas Manager at Inverkip, has been appointed to the position of Manager of the Tranent Gas-Works; and Mr. JOHN SKEA is now Manager at Comrie.

Mr. E. WOOLNOUGH has resigned the position of Works Superintendent of the Chelmsford gas undertaking, on his appointment as Working Manager of the Thetford Gas-Works.

The Rochdale Town Council, at a meeting last Thursday, received the resignation of Mr. THOMAS STENHOUSE, who for 36 years has been Analytical Chemist at the Corporation gas-works.

The appointment is announced of Captain RALPH STALEY, M.C., as Engineer and Manager to the Bishops Stortford Gas Company, in succession to the late Mr. J. W. Portass. Captain Staley was a pupil of Mr. J. C. Belton, at that time Engineer and Manager at Chester.

Mr. C. M. WALTER, Engineer in charge of the Industrial Research Laboratories of the Birmingham Corporation, has had conferred upon him the Degree of Doctor of Science by the University of Birmingham. He was largely responsible, with Captain Hilton, for the formation of the laboratories of which he has charge.

Mr. C. W. WARD, the Deputy Engineer at the Greenbank Gas-Works of the Blackburn Corporation, has been appointed Gas Engineer and Manager to the Brighouse Corporation. Mr. Ward went to Blackburn four years ago from the staff of Messrs. W. J. Jenkins & Co., Ltd., of Retford. He is the third member of the Blackburn gas undertaking's staff to gain promotion within a month.

The "South Metropolitan Gas Company's Co-Partnership Journal" congratulates Mr. C. DICKINSON GAIR (Vauxhall Laboratory), who has recently been released from his duties as a Captain in the Royal Army Medical Corps, on obtaining the distinction of Officer of the Order of the British Empire (Military Division). Congratulations are also extended, on a similar honour, to Mr. LEWIS EARP (Chief Offices), who was during the war a Major in the Army Ordnance Corps, Woolwich.

The Batley Town Council have confirmed the appointment of Mr. RUDOLPH H. DUXBURY, Assistant Manager at the works of the Longwood and Slaithwaite Gas Company, as Manager of their gas undertaking, in succession to Mr. Arthur Bromley, who has gone to Keighley. Mr. Duxbury was appointed from 39 candidates. The salary is £400 a year, the figure that he asked. Mr. Duxbury, who is only 31 years of age, and is the son of Mr. Timothy Duxbury, the well-known Oldham Gas Engineer.

OBITUARY.

The death has occurred at the age of 82, of Mr. JOSEPH KAYE, who had been for thirty years Chairman of the Douglas Gas Light Company. He was for a period of forty years on the Board of Directors.

American papers just to hand record the death of Mr. C. J. R. HUMPHREYS, Vice-President of the Lawrence (Mass.) Gas Company. For many years Mr. Humphreys was prominently connected with the gas industry; and his loss will be very widely regretted.

The death took place on the 4th inst., at the age of 73, of Mr. THOMAS COLE, Assoc.M.Inst.C.E. Mr. Cole was for a great many years Secretary of the Institution of Municipal and County Engineers; and he was brought into close association with the gas industry through being also Secretary of the Incorporated Institution of Gas Engineers, from the time of its formation on the old Gas Institute "split," until the amalgamation of the two bodies into the Institution of Gas Engineers.

ELECTRICITY SUPPLY MEMORANDA.

Doubled Pre-War Prices—And More.

The boast was made the other week that the increase on pre-war prices for electricity had not been so great as for gas. But if percentage averages were taken, there is little reason to suppose that there would be any marked difference between the two commodities. Before the boast was made, there were electricity undertakings that had passed a 100 p.ct. increase in their tariffs; there are more to-day that have done so. The 6s. rise in the price of all classes of coal has made a vast difference to generating stations; and there is now a long list of undertakings making announcements of advances, which—in the interests of new business, seeing the comparatively low value that electricity can offer for expenditure in comparison with other agents—they can ill-afford. As an instance of the 100 p.ct. line having been passed, Stoke-on-Trent may be quoted. There, a further advance of 25 p.ct. has been announced, making 125 p.ct. over pre-war rates upon all supply and other charges payable to the department. Take Hull as a further example. It occupies a favourable position for electricity business; but it has reached 68 p.ct. over the pre-war figure for flat-rate lighting, and 100 p.ct. for other purposes. It is easy enough to calculate the cost that 6s. per ton represents on the total consumption of fuel. For the Hull Electricity Department, it will mean £17,000. But the mistake must not be made of assuming that the 6s. per ton will only occasion additional outgoings for fuel. It will entail extra charges for all other goods that have to be purchased, and for repairs, maintenance, and extensions, whatever their nature. A liberal allowance must be made for these. In addition to the £17,000, the 47-hour week and other recent labour awards entail a further charge of £5000 per annum; and contingencies due to the present coal strike will require £1565—making a total of £25,539, to which will have to be added the further expenditure occasioned by the higher fuel costs of those industries from which purchases have to be made. These figures are only illustrative. There is no more reason for taking Hull than dozens of other places; but the figures happened to come before us just before writing these notes, and so we used them. While such costs continue, we may, despite the operations of the Electrical Development Association, look for a period of comparative sterility in electrical business development, apart from work that has been accumulating during the war.

Preferential Treatment of Municipal Electricity.

Gas undertakings have had their ramp in the prices of coal, other materials and goods, and labour the same as the electricity supply industry; and under peculiarly worse legislative restrictions. It is seen that at Bristol the balance of the Electricity Department is on the wrong side, which is not peculiar to Bristol. But in view of current conditions, there are councillors who are of the opinion that, wherever possible, the Corporation should oust gas, and replace it by electricity. That is very amiable on the part of the city advisers and governors. The course of action was particularly insisted upon at a meeting of the Education Committee, when discussing the question of the lighting of schools. Naturally we should not be in agreement with a submission of the kind. But, outside our interest, there are very practical reasons which should be considered. In the first place, company-provided gas supply is virtually as much a public service as is electricity municipally supplied; and gas supply pays very heavily in rates and taxes. Therefore, it deserves consideration; and municipal owners of electricity supply should not act the part of dog-in-the-manger by evicting or keeping-out gas where its retention or adoption is economically right. Light for light gas is cheaper than electric lighting; and, on the score of intrinsic brilliancy and quality, the incandescent gas mantle affords the better light, particularly where the eyesight of children is concerned. Moreover, coal conservation and the complete extraction of the components of coal by its carbonization and the making of gas, should cause municipal electricity purveyors to think nationally and not parochially. With coal at the price it is to-day, and so scarce as it is, all of bituminous character requires to be dealt with to utilize the very best service. Then consider electricity for heating and cooking purposes, if the 3420 B.Th.U. capable of being generated by a unit were dear before the war, then, for these uses, the general public cannot now avoid regarding them as much dearer still. It may be said that this applies to all fuel agents. So it does; but the public must look more narrowly now at the differences in value for a given sum. Take a unit of electricity supplied before the war at a penny, and now (say) at twopence. The 3420 B.Th.U. have descended to 1710 B.Th.U. for a penny. Take a 500 B.Th.U. gas supplied before the war at 2s. 2d. Then 19,000 B.Th.U. were purchasable for a penny, and now at 4s. 4d., 9500 B.Th.U. The attraction of this figure must be much more than the 1710 B.Th.U. of electricity. We do not claim that legitimate commercial competition should not go on between municipal electricity suppliers and gas companies working under statutory powers; but we do hold that municipal owners of electricity undertakings should not in places under their control oust gas unless they can show economy or other advantages superior to the economy and other advantages of gas. To do so is not to show that administration in the public interests is the first and dominating principle followed.

Reporting on Electrical Housing Installations.

A very interesting statement comes from Willesden. The Housing Committee there have, before considering the question of lighting the Brentfield Estate, asked the Electrical Engineer to advise them on: "(1) The system of road lighting. (2) The lighting installation for the houses. (3) The system of supply (*a*) in bulk to the Committee as estate owners; (*b*) to each house separately without separate meters. (4) As to electrical cooking and heating apparatus. (5) The estimated cost of each item, if possible showing comparative figures as against gas." Any electrical engineer confronted with this reference would be capable of presenting a very favourable report; but electrical engineers are, of course, supposed to be disinterested, and so far above all mundane or sordid considerations and so just in respect of such matters, that not one among them could omit saying all there is to be said not only favourable but unfavourable to electricity, and the same regarding gas. But still we have a feeling that, before the Willesden Housing Committee proceed to the discussion of the Willesden Electrical Engineer's report, they should place it in the hands of a gas engineer, and ask him for his comments upon it. This would be only fair, as the Electrical Engineer we see has been requested to give the estimated cost of each item, and to supply, if possible, comparative figures as "against" gas. There are other points besides electrically generated comparative figures that should be supplied to the Committee. For example, in dealing with road lighting, we wonder whether the greater diffusive power of equal candle-power incandescent gas-mantles as "against" electric lamps will escape the attention of the Electrical Engineer, and whether he will speak of the need for screening electric lamps if of the gas-filled variety on account of the abominably high brilliancy of the filaments. As to the installation costs, naturally he will try to make them look as low as possible. But electrical installation estimates, we hear, have lately been going much astray. Costly before the war, such installation work is now so much so that other than very wealthy people and profiteers find their ambition to possess electric lighting completely collapse under the shock given by the estimates. The Electrical Engineer, too, is to say something about houses being supplied without separate meters. Electric meters—structurally complicated things that they are—are very expensive nowadays; and to reduce the cost of installation work, electrical engineers, or those of them who have not had experience, are looking more favourably upon the omission of meters. But there would be just as much sense in the butcher or grocer supplying customers without scales, or Mr. Bung allowing his customers to quench their parched throats without the intervention of a measure or of himself. The report will not be complete if it does not say that several electricity undertakings have tried the system of dispensing with meters, and have found that the consumers look very generously upon the privilege of being placed in the position of determining what is fair value for the fixed price they pay. On the other hand, some electrical engineers have found that many metered houses of the smaller class use so little electricity that the costs of installation are not covered, let alone provide a profit on the current used. There comes the question of electric cooking and heating apparatus for houses such as those proposed by this scheme. This is an excellent joke. We hope the Committee will publish what the Electrical Engineer says on this subject, as most gas engineers can relate some excellent facts and tell some good stories about electric cooking and heating. The best advice that can be given to the Willesden Housing Committee is: "Be circumspect, and make searching investigation before you leap." Gas does not fear such an investigation in competition with electricity, especially under current conditions.

The Strike and the Lighting.

The coal strike in Yorkshire appears to have had a very rapid effect upon the supply of electricity, which shows that at the generating stations fuel stocks for steam-raising purposes were not great. Within a week from the start of the trouble, restrictions were placed upon the supply of electricity in several northern cities. It was decided that the electricity works at Leeds should observe a five-days' week, that the centre of the city should alone enjoy street illumination, and that the amount of lighting should be generally and rigidly curtailed. Nottingham was totally destitute of street lighting; and at Bradford it was reduced by one-half. Sheffield also came to the decision to lessen its street lighting. Derby had another taste of war conditions in respect of the illumination of its streets. And that is not the full tale.

From the Ridiculous to the Practical.

Previous references to the changes that the Electricity Bill is undergoing in Committee have shown that its character is being converted to such an extent that, when the work is completed, the original will hardly be recognizable in the finished article. We remember now the pretty pictures that were drawn by the Premier and members of the Government of rural areas enjoying, through the great national scheme, all the "blessings" of electric supply—of farmers lighting their homes, driving their machinery, and hustling the growth

of their produce by electric current, and of honest Hodge illuminating his cottage, cooking his meals, and warming himself by the same agency. All this has now passed. The electricity industry surely does not want to be saddled with a huge outlay in order to reap unprofitable business. There has been a descent from the picturesque to the practical. In the Bill, provision is made for extensive powers being given to the Electricity Commissioners, whose decrees were to be observed by the district authorities. In Committee, there was objection to the Commissioners having conferred upon them powers that might involve the district authorities in financial loss. The rural picture was brought up and derided; and the Government were plainly told that their ideas of conveying current to undeveloped rural areas was not going to be a paying proposition, and someone would have to bear the loss. From this the Government must again see how intensely they have been fooled in this matter of cheap electricity generation and supply. On behalf of the Government, it was stated that the Commissioners would only be given general directions which would be applicable alike to all district authorities. However, there was promise to meet the objection in a later clause.

Metamorphosis Continued.

Other amendments have been made in the Bill. Railway generating stations have been excluded from the operation of clause 7, which transfers generating stations, other than private stations, to the district authorities or boards. There was an amendment moved to exclude dock generating stations. The Government resisted this amendment, and were defeated. An offer was made to refer the matter to a higher authority for reconsideration, and to be brought up again before the report stage. But on a division being challenged, the amendment was carried. Then the Committee settled down to the knotty question of purchase terms. The local authorities owning generating stations had first say. What was wanted was that the original cost of municipally owned generating stations and transmission lines, less depreciation, should be paid; and an amendment to this effect was moved. As the Bill stood, those who had been repaying their debt at the fastest rate would be worse off than those who had been sluggards in this respect. Obviously this would be unfair. But looking at the matter from the standpoint of the Government, it was submitted that there was nothing unfair in taking over the liabilities of the municipalities, though there was promise that in cases where local authorities were ahead in their repayments, this would be made good to them. It was also contended that a municipality was entitled to the same consideration as a company. But the risks are different. In the case of a company's capital, the risks are personal; but with a local authority owned concern, they are not. Moreover, the electricity supply companies have submitted to restrictions and obligations to carry out public duties, and have in return been promised certain terms of purchase. The upshot was that the amendment was negatived; but a further one was accepted by the Government, to the effect that (subject to a proviso) a local authority, in lieu of an annuity, should be entitled, if so desired, to be paid a sum to be determined in default of agreement by an arbitrator appointed by the Board of Trade.

GAS STANDARD OF 570 B.TH.U. OFFICIALLY RECOMMENDED IN INDIANA (U.S.A.) STATE.

A REPORT issued by the Gas Standards Committee appointed by the Indiana Public Service Commission, and published in the "American Gas Engineering Journal," presents a fair all-round statement of the interests affected by fixing the standard for gas to be supplied in any district. It comprised four members only—a remarkable contrast to the British penchant for large committees even if they include several mere figure-heads. But they were all "live wires." Mr. H. O. Garman (Chairman) is the Chief Engineer of the Indiana Public Service Commission; the Municipal League of Indiana is represented by Mr. H. C. Peffer; Mr. A. G. Phillips is an Associate Engineer of the United States Bureau of Standards; and Mr. C. O. Bond was deputed by the Indiana Gas Association. In the collection of data they were assisted by Mr. H. B. Heign, of the State Commission engineering staff, and Mr. M. J. Frankel, of the Bureau of Standards; and in working tests in fourteen districts other members of the Commission and Bureau, and gas engineers interested were concerned. The work throughout was evidently conducted with competence and efficiency.

The appointment of the Committee was the result of war-time difficulties, due to the shortage of gas-oils, and the need for using local coals that were troublesome to handle and gave poor working results. The coke was so inferior that it greatly reduced the efficiency of the carburetted water gas cupolas. In the hope of conserving these materials, the United States Fuel Administration ordered that the heating power of the gas sent out should be reduced to 528 B.Th.U. Naturally, the gas service was impaired, and consumers' complaints were numerous. A meeting attended by the city authorities and gas officials from all parts of the State was held last October, when the engineering department of the State Commission presented a new set of regulations for consideration, previous to final adoption. The impracticability of keeping up the present 600 B.Th.U. standard was very generally admitted; but opinions were diverse as to a substitute, and but little information was available. The result was the appointment of a Special Committee.

The work undertaken comprised the collection of working data from official reports and from the undertakings concerned, exhaustive special tests on representative plants, and short visits to coal-gas and coke-oven works so as to get general information. After the signing of the armistice, coal and oil shortage became less acute; and districting arrangements were abolished. But they decided to continue the work, which became more of an investigation of peace-time rather of war-time conditions. Working tests at a few gas-works yielded such useful results that they were extended to include fourteen undertakings, and not only the heating value that was being obtained, but that which in the opinion of the Committee the plant was capable of producing.

After independent examination of the figures, and before discussing them, each member was asked to name the standard that he would accept as correct. The conclusions were practically unanimous; the extreme differences being only 15 B.Th.U. They decided that the fixing of a standard for any district called for careful consideration and sound expert judgment of economical factors, practical working conditions, and maximum satisfaction to the consumers. A suitable figure for one State was not necessarily the best for another, though some States had simply accepted established precedent. Type of plant, character of coal, and other local considerations were things that must not be overlooked.

Consumers cared little about B.Th.U., &c., but were mightily interested in the size of the monthly gas bill, and the avoidance of troubles such as striking-back or sooting mantles. The gas that would give best all-round satisfaction was one that would do the lighting, heating, and cooking efficiently under ordinary household conditions, with the smallest bill at the end of the month. But cost was not the sole criterion. A gas that gave the best service might be difficult or costly to make, and for that reason prove unsatisfactory to the user; and working trouble would mean dissatisfaction, even with a small bill. So the mere averaging of the best heating values obtainable did not give a complete answer.

Uniformity of quality was perhaps the most important factor in good service; and, within reasonable limits, the average value was less important. Low value caused flash-backs and other annoyances, but no positive loss; but excess quality was not only attended with smoke or soot, which meant unsatisfactory service combined with financial waste. In one district, satisfactory results were obtained on a low but uniform quality of gas; in another, with high quality but variable limits of 100 B.Th.U., there was constant complaint. The Committee believed that the present-day appliances could be adjusted for satisfactory service, to limits not exceeding 550 to 600 B.Th.U. gas; and they suggested a maximum in addition to a minimum value—the limits being 5 p.ct. from the standard average in each case. This point should be considered in fixing the standard, as strained working conditions one way or the other were always attended with wide variations and unsatisfactory service. A high quality gas, if uniform at the works, was liable to be affected by temperature conditions in the distributing mains.

While not inclined to discourage high heats and other legitimate means of increasing the yields of gas, even at some expense of quality, the Committee firmly oppose a standard so low as to admit the use of diluents in large quantity. A sharp distinction should always be made, they say, as the effect on services was very different. Small quantities of diluents could not be avoided, and did no appreciable harm; but in large quantity they decreased heating value, air complement, flow through the burner orifice, and increased the specific gravity. A too lenient standard might also lead to carelessness at the works; plant not kept in proper going order or repair; and general disorganization of the whole morale. But for coal gas the Committee advised a standard low enough to admit of uniformity, with an equipment in sound condition, and to encourage the use of local coal. For practical reasons, the standard for carburetted water or mixed gas should be the same, although it was quite possible to maintain 600 B.Th.U. if sufficient oil was available.

They decided to recommend 570 B.Th.U., with a margin of 30 B.Th.U. each way, as the most suitable standard. For bye-product coke-ovens and other special circumstances, some reduction might be allowed by the Commission, after full investigation of each case; but the limit should be 550 B.Th.U., with a margin of 27·5 B.Th.U. each way.

Bricks for Coke-Conveyor Wearing Surfaces.—The "American Gas Engineering Journal" says that bricks form the wearing surface of a coke-conveyor recently rebuilt at the works of the Atlanta Gas Light Company. This plan was adopted in lieu of the original purpose to line the bottom of the conveyor with railroad iron. It is believed to be a much better arrangement; the conveyor being resilient, water-tight, more or less proof against rust, and its wear being concentrated on a surface which can easily be replaced. All the bottom was lined with bricks moulded underneath with longitudinal flanges that lift them above the floor of the channel. Hot pitch was poured into the cracks between the bricks, and filled not only these but the channels between the projections on the bottom, thus giving the necessary elasticity with the other good qualities mentioned.

GAS-WORKS POWER PLANTS.

JUDICIOUS MODERNIZATION.

By H. C. WIDLAKE, A.M.I.E.E.

Plymouth and Stonehouse Gaslight and Coke Company.

(*Continued from p.* 287.)

WE can now proceed to draw a comparison between the steam-engine (in the case of a steam-driven station) used for dynamo driving and the steam-engine which it is proposed to replace with an electric motor. In fig. 1 is shown a modern high-speed engine by Messrs. Bellis and Morcom, whose name is a household word in the power stations of the British Empire. This type of compound double-acting, self-lubricating engine is admirably representative of the class of engine used for the driving of moderate powered sets in steam-power stations.

During the past few years many engines of the general type of this Bellis and Morcom engine have been placed on the market by the large engineering firms; and in going into the question of power costs in connection with this particular type of machine, it is felt that it would detract from the value of this contribution if the fuel charges were based upon the low running costs associated with the particular engine selected to illustrate this type. It is therefore proposed to take a fuel figure per B.H.P. hour which will be generally applicable to engines of this class; but it must be distinctly understood that the figure so taken does not in any way represent the best of which a high-class engine of this type is capable.

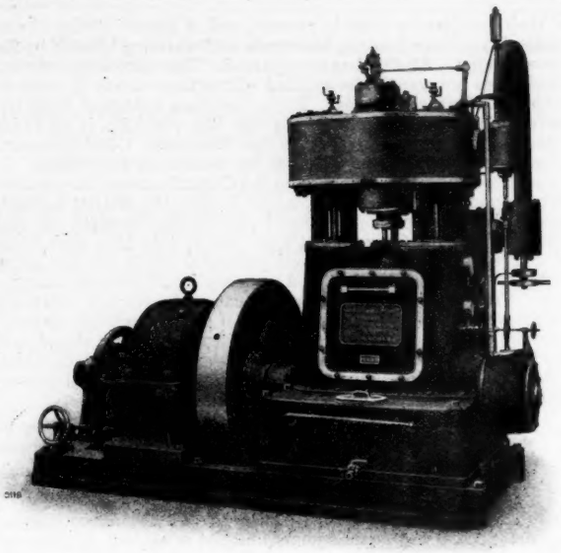


FIG 1.

For the purposes of comparison, we will therefore assume that an engine of this general type, running non-condensing under an average plant load factor of 70 p.ct., would consume about 30 lbs. of steam per B.H.P. hour. On an evaporative basis of 6 lbs. of water per pound of fuel fired, this gives us a fuel consumption of 5 lbs. per B.H.P. hour. Before the power so generated can be delivered (*via* the electric system of power application) to the objective of the plant—namely, to the power-driven units of the works machinery—certain losses will be incurred; and it is proposed to deal with such losses in a later portion of this article. The comparisons with which we are immediately concerned in this portion are purely mechanical.

Turning, now, to the steam-engine on the works which we are proposing to replace with an electric motor, and bearing in mind Sir Frederick Bramwell's census, which (generally speaking) concerned engines of this type, we shall be on the safe side in assuming an efficiency (so called) of 70 lbs. of steam per B.H.P. hour. This figure does not take into account evaporation or condensation losses in the long run of steam-pipe through which these engines often draw their supply of power from a distant battery of boilers. On the 6 lbs. basis of evaporation, we find that the fuel consumed per B.H.P. hour will be 11·6 lbs., or 132 p.ct. more fuel than would be required by the modern high-speed type of dynamo driving engine to which reference has been made.

So much for the relative performances of an ancient and a modern steam-engine. But when we come to the case of the gas-engine, and attempt to draw a similar comparison, we do not find such grounds for the condemnation of the more ancient machine. Figs. 2 and 3 illustrate, respectively, the horizontal and vertical types of modern dynamo driving gas-engines, with one of which types we may take it that electricity will be generated in a gas-driven generating station. Such engines, running on the load factor mentioned with gas having an average calorific value of 560 B.Th.U., will take about 20 c.ft. of gas per B.H.P. hour.

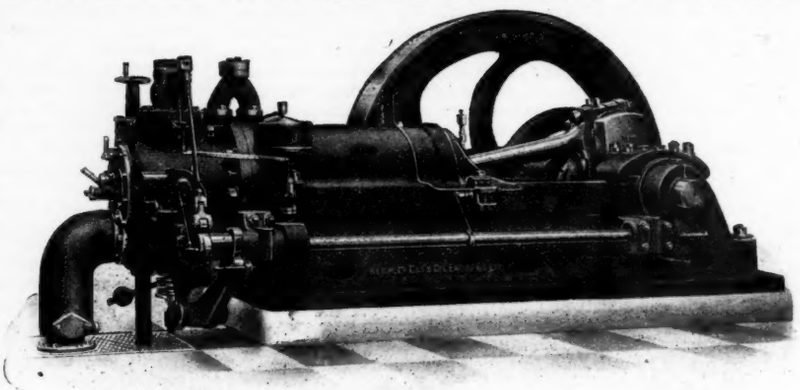


FIG. 2.

Turning for a moment from the modern sets in the power-house, let us consider the older types of small gas-engines used on so many works for the driving of various types of industrial machinery. In common with most engineers whose business brings them into constant contact with gas-engines, the author has repeatedly been struck by the maintained economy of many old gas-engines which, by all rules of depreciation, should have been on the scrap heap years ago, but which are still running with such a degree of economy as to quite outrule any question of replacing them by an internal combustion engine of more modern design.

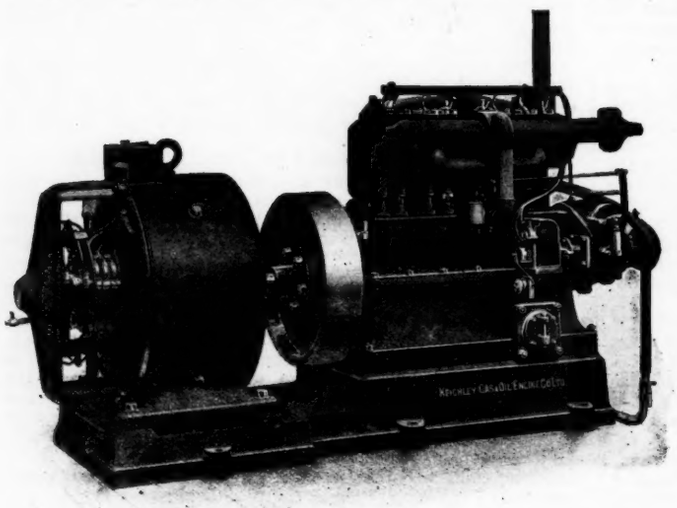


FIG. 3.

Years of accumulated and well-applied experience have brought about many refinements in gas-engine design. A higher degree of reliability in respect to certain portions of the engine has no doubt been attained. Lubrication charges are much less, and it is now possible, power for power, to manufacture a considerably smaller machine than was on the market (say) 15 to 20 years ago. But apart from these improvements, the type remains the same, and any increase in efficiency which may have been attained is trifling as compared with that which, in the case of the steam-engine, has been gained by compounding, and so taking advantage of the expansive properties of steam. As illustrating this point, the author might mention two installations with which he is connected. One consists of a 22 year old 6 B.H.P. Crossley engine, running at about 160 R.P.M., used for industrial purposes, and the other installation of a pair of 10 B.H.P. Crossley engines installed four years ago for the purposes of dynamo driving, and running at 320 R.P.M. The older engine has been worked hard; and beyond periodical attention to the valves, very little has been

done to it. To-day these engines run with nearly the same degree of efficiency—varying from 21 to 23 c.ft. of gas per B.H.P. hour.

A LIKELY QUESTION.

A likely question which may arise in the mind of the works engineer who has under consideration the modernization of his works power-driven units of plant may be expressed as follows:

> Seeing that the main factors which contribute to high power charges on my works seem to lie in the fact that the steam-engines by which I drive my elevators, conveyors, &c., &c., are of the single cylindered type, would it not serve my purpose equally well if, instead of putting down an electric power system, with its attendant complication of engines, dynamos, switchboard, motors, &c., &c., I simply replace these ancient steam "eaters" with a modern type of totally enclosed compound engine of exactly the same class, only smaller, as is used with so marked a degree of economy for the purpose of dynamo driving?

This, at first sight, would seem to be a very simple solution of the matter. But on looking closely into the question, we are reminded that the long runs of steam-mains, with all their power-absorbing propensities, will still have to be used to deliver power to the new modern engines; so that the fuel which the installation of these engines about the works would certainly save will be much less than the saving which would be effected by the laying down of an electric system of power generation, transmission, and application.

TRANSMISSION LOSSES.

The losses which occur in connection with a number of isolated steam-engines deriving their steam supply from a more or less centrally situated battery of boilers are by no means easy to estimate. Much depends upon the conditions pertaining in each individual case—such as the degree of shelter afforded to the runs of steam-main, the amount of uncovered pipes and flanges, the number and general condition of steam-traps, and the facilities (or lack of them) afforded for getting at joints, &c., &c. One thing, however, is certain—losses are continually taking place, due to condensation and radiation, irrespective of whether an engine (or engines) is working or standing.

Various figures have been arrived at by different experimenters in this direction; but so much depends upon local conditions and the degree of attention given to the steam-mains that it is difficult to find even an average figure at which to place such losses. On a carefully maintained and handled system they may be kept fairly low. Such systems are, however, rarely met with, as it must be remembered that an engineer in charge of a large works who can tolerate the sight of old single cylindered steam-engines (or rather steam wasters) eating into his residuals profits is not likely to worry much about a few weeping joints or blowing traps, but is rather inclined to regard them as a necessary evil. On a ramshackle plant with an arterial system of bare steam-pipes running through draughty coal-stores, dark corners, and inaccessible places, such losses may easily result in doubling the steam consumption actually required for the working of the engines themselves.

Where engines are situated in close proximity to the boiler or boilers from which they derive their supply of steam, condensation losses may be kept fairly low; but where considerable distances exist between the engines and their source of power, it will be found that the average single-cylindered non-condensing engine will take about 100 lbs. of steam per B.H.P. hour. This figure will be adopted as a basis for this type of engine in the comparisons which it is proposed to make later on.

Another point which has a bearing upon such matters is the fact that the exhaust steam from a number of isolated engines cannot, generally speaking, be made to perform any useful work; whereas in the case of steam-driven generating sets the exhaust from the engines may be either recovered by means of condensing plant, or, alternatively, it may be used through a feed-water heater, and so effect an economy of about 8 to 10 p.ct. on the fuel bill. This latter method is preferable for dealing with the exhaust of small and medium-sized generating sets—say, under 150 KW.—unless it happens that the feed water is expensive. On many gas undertakings the effluent from the gas-condensers is used as boiler feed; so that the water charge for power generating is practically *nil*.

GAS-ENGINES.

As regards the losses incurred in the transmission of gas to engines situated within the confines of the works, such losses may be safely regarded as negligible, and for the purposes of our comparisons may be safely ignored.

ELECTRIC MOTORS.

In connection with the electrical system of power application, three losses have to be considered as taking place between the crankshaft of the engine driving the generator and the driving pulley of the works motors. The first loss is that attending the conversion of the mechanical effort exerted by the engine into electrical power. Its actual amount will depend upon the speed and capacity of the generator; but in the case of the sets which have been selected as a basis of comparison, we shall be safe in assuming that 90 p.ct. of the power developed by the engine will be available for distribution at the dynamo terminals.

The second loss will be incurred in the transmission of the power from the dynamo terminals to the various electric motors on the works. It will vary directly with the length of the feeder lines and inversely with their sectional area.

The third loss will be incurred in the re-conversion of the electrical energy delivered to the motors into a mechanical form, and will take place in the motors themselves. As in the case of the first loss, its actual amount will depend upon the size and speed of motor and the load factor under which it is working. A safe average figure to take for the various sized motors used on most gas undertakings is 85 p.ct.; and it will be assumed that this proportion of the electrical energy delivered to any particular motor will be available in a mechanical form at the pulley end.

Roughly speaking, we may take it that 30 p.ct. of the power developed by the dynamo engine will be absorbed in the processes of generation, transmission, and conversion, and that for every 746 watts developed by the dynamo engines 520 watts will be available for actual work by the works motors. The value of these factors in assisting one to arrive at a safe decision in respect to plant modernization cannot be better shown than by applying them to some typical case. Let us therefore take the case of an engineer who has installed upon his works a modern gas-driven generating set, and who is considering whether it will pay him to electrify two coal-elevators in his retort-house, one of which is driven by an old gas-engine and the other by a simple non-condensing steam-engine. We will assume that his steam is raised with coke breeze valued at 6s. per ton, and that the cost of his gas into the holder is 2s. per 1000 c.ft.

Taking first the cost of the available electrical energy, and assuming an engine efficiency of 20 c.ft. per B.H.P. hour at the dynamo coupling, the fuel charge per B.H.P. developed by the engine will be 0·48d. It has been shown, however, that three losses must be faced before the power developed by the engine driving the dynamo can be delivered at the shaft of the electric motor; and taking the overall efficiency of the conversions and transmission between the engine crankshaft and the motor driving pulley as being 70 p.ct., we find that, in order to obtain one B.H.P. hour at the motor pulley or coupling, about 29 c.ft. of gas will be required at the generating set. Thus, on the basis of 2s. per 1000 c.ft., the cost of one B.H.P. hour developed by the motor will be 0·696d.

Let us next take the case of the retort-house elevator driven by the old gas-engine. This engine, though probably of an ancient type, will, as has been shown, be capable of running with a high degree of economy, and it may be assumed that 25 c.ft. of gas will be required to develop one B.H.P. hour, and the cost of power generation will be 0·600d. per B.H.P. hour.

Taking next the case of the steam-driven elevator, and remembering the long run of steam-main through which the engine will derive its supply of power, we will assume its consumption to be 100 lbs. of water, or 16·6 lbs. of fuel, per B.H.P. hour. With fuel at 6s. per ton, the cost of running this engine will be 0·534d. per B.H.P. per hour.

The costs per B.H.P. hour of running these three respective types of power motors will thus be as follows:

Electric motor	0·696d.
Gas-engine	0·600
Steam-engine	0·534

These figures, it must be remembered, represent the cost of fuel alone, and do not take into account capital, water, labour, and lubrication charges.

So far as the comparison between the old gas-engine and the electric motor is concerned, it will be noticed that the former, despite its age and antiquity of design, is more economical than the electric motor supplied with power from a modern type of gas-driven generating plant, as, although the dynamo-driving engine runs at a higher efficiency than does the old gas-engine, yet the losses between the coupling of the generating set and the pulley of a motor more than balance the advantage which the modern gas-engine has over the older type as regards efficiency.

When we take capital, water, and lubrication charges into consideration in connection with the foregoing case, we find there is not much to choose between the three types of motors; and any proposal to throw out the steam and gas engines and replace them by an electric motor will have to be considered from a standpoint of local conditions, such as disposition of labour, space economy, &c. There is certainly not much to be gained by such a change so far as actual running costs are concerned.

The above example states the case fairly where the electrical plant is gas driven. It is now proposed to consider this same problem in connection with a works on which electrical energy is generated by high-speed reciprocating steam-engines of the "Bellis" type. In this case the running costs of both the gas and steam driven elevators will remain the same as previously; but the cost of electrical energy will have dropped considerably.

Dealing, first, with the generating sets, and assuming an engine efficiency of 30 lbs. of water per B.H.P. hour, and taking the overall transmission efficiency at 70 p.ct., we find that, in order to develop one B.H.P. hour at the motor pulleys, we shall require 43 lbs. of steam at the generating set costing—an evaporation of 6 lbs. of water per lb. of fuel fired is assumed—0·230d.

Again summarizing, the respective fuel costs in this second case will be as follows:

Electric motor	0·230d.
Gas-engine	0·600
Steam-engine	0·534

It is quite obvious in this case that the interests of economy

will be best served by the relegating of both the elevator gas and steam engines to the scrap heap and the installation of electric motors in their places. The consideration of labour, capital, water, and lubrication charges in this instance only makes the case for the electric motor a better one. It must be recognized that such low-power costs as are shown in this connection are only possible on works where there is an ample supply of breeze available for steam-raising purposes. If good coke had to be used under the boilers, the case would be altered altogether, and the gas-driven sets would prove to be the most economical.

(To be continued.)

CARE OF RETORT-HOUSE ELECTRICAL PLANT.

By E. DAVIES, of Beckton.

ELECTRIC motors working in retort-houses are frequently to be seen running under severe conditions. They may be subject to high temperature, from the surrounding atmosphere, or exposed in a locality where the air is always impregnated with coal dust, or fixed on such a flimsy foundation that excessive vibration ensues, with disastrous results to the motor. One may often come across instances where contractors when installing coal-handling plant have merely bolted the motor direct to a chequered-plate foundation. These holding-down bolts should always pass through steel joists or channel bars placed under the chequered plate as stiffeners to ensure rigidity. It is also good practice to place a pad of sheet-lead, ¼ in. thick, between the motor feet and the chequered plate, as this leads to the diamond stripe of the plate and any irregularities in the cast feet of the motor being firmly embedded in the lead when the nuts of the holding-down bolts are tightened.

In the majority of electrically driven coal-handling plants the motors drive with direct gear; and in choosing this, it should always be borne in mind that machine-cut gear is the most suitable for preventing vibration on the armature shaft, and that a compressed paper pinion engaging with a steel spur-wheel, is noiseless and cheaper than having all steel or cast-iron gearing; and in the event of a paper pinion tooth breaking, the spur-wheel is not damaged thereby. In retort-houses equipped with continuous, overhead coal-storage bunkers, supplied with push-plate conveyors, and only working during the day, it will be obvious that the maximum load on the conveyor motor is when the coal is being carried along the conveyor trough to the farthest point from the delivery shoot of the elevator, as the trough is then full its total length. This maximum load should be dealt with when starting the plant in the early part of the day. The motor is then cool after standing overnight; and as the successive compartments of the bunker are filled, the load on the motor is lessening all the day. If, however, the maximum load is left to be dealt with in the latter part of the day, the motor (through working continuously) will have warmed-up and may not be equal to taking an increased strain. One may thus often see motors having enforced rest periods where attendants work on the latter method.

When the conveyor is brought to a standstill by its motor fuse blowing, the elevator generally continues working, with the result that the standing conveyor gets choked at the feeding shoot. This surplus coal should always be cleared away by hand before restarting the motor; and as the conveyor trough may also be full when the fuse blows, it is advisable to have the starter fitted with a resistance capable of starting-up on full load, or else vivid arcing will be set up on the starter's segments, with resulting damage to the motor. Most coal plant shunt-wound motors run at 1000 revolutions per minute; and at this high speed ordinary machine oil may be flung about the motor internally, to the detriment of the insulation. For this reason, thick cylinder oil has been tried, but has proved a failure, as the oiling rings were not always positive in revolving in the thicker oil. The trouble was eventually overcome by using a commercial castor-oil which, although more expensive than machine oil, was found to be very satisfactory.

Great care should be taken to see that motor-bearing oil-wells are not overfilled, and that the overflow is not choked. One of the best motors (from a commutation point of view) now on the British market has a drawback in the fact that the makers place the field-coils on the horizontal and vertical centre lines. This leads to the bottom field-coil becoming a receptacle for all oil carried over, with ensuing insulation troubles. Other makers place the field-coils midway between the horizontal and the vertical positions. It is impossible in some instances to prevent oil getting into the motor interior, as take the case of a retort-house telpher negotiating a 20 feet radius curve when the swinging of the telpher cab transmits the oscillation to the motors and the oil is thrown out of the bearing wells.

The question as to whether a retort-house motor should be of the semi-enclosed or the totally-enclosed type depends upon local conditions. The former is unsuitable where coal dust is prevalent, as the dust is a conductor, and may lead to a bridging-over or short-circuit, and the latter type should not be fixed where the atmospheric temperature is high.

The writer came across a 15-H.P. motor, delivered to a municipal gas undertaking last year, in which, although totally enclosed, the makers had fixed a fan for air circulation, upon the armature shaft. This useless article was constructed so flimsily that, shortly after the motor was put to work, the impeller vanes became detached and got wedged between the armature and the field-coils and considerably damaged the insulation of both. End play of the armature shafts should never exceed one-sixteenth inch, and in some gas-works, discarded gun-metal bearings (instead of being scrapped) are put in the lathe and cut up into rings varying from ⅛ in. to ⅜ in. in width, which are inserted to take-up excessive end play through wear, and also to act as friction washers. But, before starting the motor, care must be taken to see that the brush-holders do not foul the armature winding.

On the motors that are supplied with the Fiddes-Aldridge stoking machines, the wooden blocks carrying the brush-holders require frequent observation, as the wood shrinks with the heat, through being in proximity to the hot chain, and the carbon brushes—instead of making firm contact—will be found to be dithering on the commutator and causing sparking. The wood blocks, which are made from well-seasoned beech, should be given a good coat of shellac varnish each time the motor is overhauled. The mica division strips between the copper bars of the commutators of all motors require to be kept slightly below the surface of the copper bars; and for this purpose a piece of old hack-saw blade is useful.

In conclusion, it may be pointed out that, to ensure smooth working and detect defects before the breakdown stage is reached, an insulation test should be made weekly with a reliable ohmmeter, and a pole-gap test monthly—that is, checking the clearance space between the armature and the field-coils, with flat steel testers, the thickness of which are denoted in gauge numbers. Any great inequality in the clearance space is the danger signal that the bearings are worn and require renewal.

A Temperley Transporter at Dawsholm.

There is illustrated and described in the current number of "Engineering" a revolving double-cantilever "Temperley" transporter erected at the Dawsholm Gas-Works of the Glasgow Corporation by Sir William Arrol & Co., Ltd. The cantilevers are carried by a steel-framed tower, mounted on a circular brickwork pier. This arrangement enables a clear lift of 50 ft. to be obtained; while the cantilevers are of such a length that the load can be handled at any point up to a maximum distance of 100 ft. from the centre. Thus, except for the small portion occupied by the brick pier, the whole area of a circle 200 ft. in diameter can be covered. The transporter is used for conveying coke from the quenching pit to the storage yard; and also for loading it into railway trucks and road vehicles. It is fitted with a "Temperley" patent grab-bucket, capable of holding about a ton of coke. But an automatic dumping skip, of a capacity of 2 tons, is used when taking coke from the quenching pit; and with this the transporter can handle, approximately, 50 tons per hour. The movement of the traveller along the beam is effected by a high-speed single drum winch driven by a 25 H.P. motor; while the grab is actuated by a double drum winch driven by a 50 H.P. motor. A centre-pin working in a bearing carried by the tower forms a pivot about which the whole transporter revolves; the revolving being caused by a 12 H.P. motor through worm and spur reduction gearing so arranged that the transporter makes a complete revolution in two minutes.

Radiant Heat.

In a paper which he read before the Southern Gas Association of the United States, Mr. J. P. Conroy expressed himself as so enthusiastic about radiant heat that he believes it will in time revolutionize the gas business, or the gas appliance business. It has been the impression of many that radiant heat is only given off from a red-hot mass; but this is not the case. Any heated substance gives off radiant heat to a certain extent. Blue flames from a bunsen burner give off a certain amount of radiant heat; and it might surprise some of the gas-stove men to learn that in the space from the top of the burner of a gas-range up to the bottom of a cooking utensil—which may not be more than an inch—there is a certain amount of radiant heat being given off on a horizontal line from the flames. This heat is wasted entirely, as it does not come into contact with the cooking utensil. "I am," he went on, "surprised at you gas men—and especially you gas engineers—who have had radiant heat before you all the time, and still never seemed to recognize it and understand the laws." Not only does he believe that radiant heat will revolutionize gas and gas appliances, but he is of opinion that it will revolutionize the heating of American homes—though this is not all going to happen in a day. Radiant heat can be directed, and put where it is wanted. It does not necessarily go up or down, but where it is directed, just the same as light. In making his remarks, he was directing attention to a particular type of American gas-fire—the "Radiantfire"—and when this is used it is claimed that "nearly all the heat from the gas-flames is absorbed by the radiants, which get red-hot, and reflect nearly all, or at least 80 p.ct. of all, the heat right straight out into the room."

No investment in power plant equipment will pay a higher rate of interest than will a well-used gas-analysis apparatus. The control of the air supply is absolutely indispensable to the efficient operation of a furnace. Means of attaining this end are explained in Technical Paper No. 219, on "Combustion and Flue Gas Analysis," issued by the United States Bureau of Mines.

THE "BACKWARD ROTATION" SYSTEM OF PURIFICATION.

Direct Process of Sulphate Making and Ammonia Losses.

As mentioned in last week's "Journal," Mr. W. S. Curphey (the Chief Alkali Works Inspector), in his report for 1918, further deals—in relation to the investigation into ammonia losses in the "direct" process of sulphate making in gas-works—with the working of purifier sets on the "backward rotation" system. During the year reviewed, a complete system of control of the purifiers experimented with (as recorded in the 1917 report) was established; and Mr. Curphey says this has furnished data of exceptional interest, as affording evidence of the advantage of instituting a complete system of scientific control of purifier working where the magnitude of operations enables the management to supplement the collection of data by laboratory analysis. This section of Mr. Curphey's report [omitting some diagrams and tables giving details of the experiments] is reproduced below.

The working of plant for the manufacture of sulphate of ammonia by what is known as the "direct" process has been the subject of special study and research during the past four years. In these investigations, typical plants have been kept under continual observation, with a view to ascertain the causes of the periods of disorganization which characterized the process at its inception. The conclusions arrived at from a study of the data furnished by this research have enabled various suggestions to be made for more scientific control of purifier working by regulation of temperature, ammonia content of crude gas, and humidity of oxide, and for reduction of working losses by better circulation of acid liquor in the "bubbler," and more careful attention to the working of the virgin liquor still. The results of these early investigations were presented in the annual reports for 1915, 1916, and 1917.* Attention in 1917 was mainly directed to the systematic collection of data relating to the yield of ammonia from the retorts under varying seasonal conditions, and to the study of retort-bench temperatures.

In 1915, attention was directed to the advantage of working the purifiers on a "rotation" system, coupled with downward flow of gases, and the matter was again referred to in 1916. An interesting series of experiments on the working of a purifier set on the "backward rotation" system was carried out by the manager of Works "E" from April to August, 1917. At that date the valve-fittings did not permit of working on strictly orthodox lines; but in 1918 the necessary alterations to the plant were effected and a complete system of control established which has furnished data of exceptional interest.

War conditions at Works "G" rendered it impossible for Mr. Codgbrook to continue in detail the experiments which he conducted with so much zeal and success in 1916 and 1917; but he was able, in the spring of 1918 to insert a secondary main, with the necessary valves, to enable the purifiers to be worked with downward flow of gases. The boxes are too small to permit of experimental working on the "backward" system, with a reduced staff and fluctuating make of gas. The "neutralizing-box" referred to in 1916 has been replaced by a "neutralizing-pipe." The purifiers are now completely housed-in, which has enabled temperatures to be maintained without recourse to the use of steam. The manager now relies on the due regulation of the ammonia bye-pass and air-supply valve to activate the oxide during periods of exceptional pressure.

At Works "H," experiments have had to be entirely suspended, owing to war conditions.

Ammonia Losses.

With respect to working losses generally, which are still regarded as exceptionally great at many of the works operating plant of the "direct" type, further experience tends to confirm the conclusion arrived at in 1916 that too little attention is paid while distilling the virgin liquor to the due adjustment of the lime and liquor feeds. The ammonia content of virgin liquor is by no means a constant quantity; nor is the quality of the lime always beyond reproach. Moreover, the advantage of a continuous lime feed is insufficiently appreciated, even at works where the scale of operations would fully justify its adoption. The preceding figures are of significance, as indicating the difficulty of safeguarding losses in the effluent spent liquor from the still, even where samples are systematically submitted to analysis in the laboratory, and where in other respects the control of operations leaves nothing to be desired.

Ammonia Losses at Purifier and Still.

Entering Purifier.			In Effluent Spent Liquor.		
Date of Test.	Ammonia Grains per 100 C.Ft.	Equal to Lbs. of S/A per Ton of Coal.*	Average for Month.	Ammonia Parts per 100.	Equal to Lbs. of S/A per Ton of Coal.†
April . . .	—	—	April . .	0·102	1·6
May . . .	—	—	May. . .	0·090	1·4
June 13 . .	0·5	0 04	June . .	Idle	—
,, 17 . .	1·2	0·09	July. . .	Idle	—
July 3 . .	2·0	0·14	August . .	0·114	1·7
,, 30 . .	6·4	0·46			
Aug. 8 . .	8·0	0·58			
,, 20 . .	5 0	0·36			
Average .	3·9	0·28	Average .	0·102	1·6

* Taking 13,000 c.ft. of gas per ton coal. A varying proportion of the NH_3 entering the purifier is recovered in the condensed liquor.
† Taking 40 gallons of effluent per ton coal.

At three works the function performed by the "neutralizing-box" has been effected in a simpler manner, and at less cost, by the introduction of what may be termed a "neutralizing-pipe" in the "bubbler." This pipe enables vapours from the ammonia still to be delivered direct to a point just above the bottom of the "blubber," which in this respect performs the function of a saturator. Very favourable reports have been received respecting the efficiency of this device; and its continued working will be watched with interest.

"Backward Rotation" System of Purifying.

The results obtained at Works "E," with purifiers worked on the "backward rotation" system with downward flow of gases are of exceptional interest, as affording evidence of the advantage of instituting a complete system of scientific control of purifier working at a works where the magnitude of operations enables the management to supplement the collection of data by laboratory analyses. The Department is greatly indebted to the manager for the valued results of this prolonged systematic research. Results were co-ordinated and averaged here; but the temperature data and many of the analytical figures were furnished by the manager, who not only supervised the work of his staff, but himself verified the results of their observations.

Works "E."

Working of the "Backward Rotation" System with Downward Flow of Gases.

The earlier history relating to this work will be found recorded in 1915, 1916, and 1917.

The following particulars relate to average working conditions as regards make of gas and weight of coal carbonized:

Coal.—Yorkshire, screened nuts: Maximum average coal used per 24 hours, 46 tons. Minimum average coal used per 24 hours, 33 tons.

Gas.—Maximum average make, 648,000 c.ft. per 24 hours = 14,100 c.ft. per ton coal. Minimum average make, 427,000 c.ft. per 24 hours = 12,950 c.ft. per ton coal.

Purifiers.—Four, each 24 ft. square, with three layers of oxide, 9 in. depth, about 40 tons in all per box.

Area of each purifier, 24 ft. by 24 ft. = 575 sq. ft. (approx.).

Total volume of oxide (four purifiers) = 5175 c.ft.

Volume of gas passed per 24 hours per sq. ft. superficies:
Maximum make, 1120 c.ft.
Minimum make, 740 c.ft.

Volume of oxide per 1000 c.ft. of gas passed per 24 hours.
Maximum make, 8·0 c.ft.
Minimum make, 12·1 c.ft.

During the actual period of the test, which extended from April to December, 1918, the maximum make of gas on any one day was 534,000 c.ft. (Nov. 28), and the minimum make, 328,000 c.ft. (June 25); the average for the whole period being 385,000 c.ft.

The purifiers are built on columns, and are exposed to free circulation of air at the sides and below. They are under a roof, and the lids are now protected by wooden covers and lagging. Special channels were introduced in 1918 to enable the boxes to be worked with downward flow of gases.

Temperature is regulated by means of thermometer tubes, each with its upper end inserted through the central fixed plate in the purifier cover, and its lower resting on one of the three grids, and embedded in the oxide (as described in 1916). The ammonia content of the gases is regulated by means of the same tubes; the condition of the gases, *quâ* ammonia, being determined periodically by allowing the gases to impinge upon a strip of moistened litmus paper. During the period of the test, the thermometers in the various carriers were changed from time to time to eliminate errors due to graduation. Ammonia is supplied direct to the purifier first in series by means of a bye-pass carried from the crude gas-main entering the "bubbler" to the inlet-main to the boxes. No ammonia is now admitted direct to the purifier second in series.

Oxide.—Bog ore, with a proportion of partially spent oxide.

"*Acid Bubbler.*"—6 ft. square by 4 ft. high. The crude gases

* See "Journal," Vol. CXXXV., p. 606; Vol. CXXXIX., pp. 281, 322, 372; Vol. CXLIII., pp. 68, 111.

were formerly passed through a washer fed with ferrous sulphate for removing hydrocyanic acid, but now enter the "bubbler" direct. The latter also receives ammonia from a continuous still fed with virgin liquor. The lime-feed is here continuous.

Efficiency of Purifiers.—The efficiency of any given system of purifiers is measured by the absolute volume of foul gas (sulphuretted hydrogen) absorbed by the oxide prior to its final discharge, and by its capacity to deal with extreme makes of gas under varying seasonal conditions. Judged by this standard, the adoption of the "backward rotation" system with downward flow has fully justified itself at Works "E;" and the recovery figure for sulphate is equally satisfactory. The following particulars will serve to illustrate the progressive improvement effected since 1915, when the "direct" process was first installed. A modified "backward rotation" system with upward flow of gases was in operation from April to August, 1917. The complete "backward" system with downward flow was installed in April, 1918, and is still in use:

Year.	Number of Purifiers Changed.	Gas Made, Cubic Feet.	Average per Purifier, Cubic Feet.	Lbs. S/A Recovered per Ton Coal.
1915 . . .	26	169,283,000	6,500,000	18·5
1916 . . .	17	152,107,000	8,900,000	21·2
1917 . . .	17	176,885,000	10,400,000	20·7
1918 . . .	10	152,103,000	15,210,000	24·0

Regulation of Working of Purifier System.—The conditions best suited to maintain the purifying material at its highest state of efficiency were fully discussed in 1915 and 1916. Temperature, humidity of oxide, and ammonia content of gases were all regarded as critical factors. Importance also was attached to a cyclic "movement" of the boxes.

On *a priori* grounds, the "backward rotation" system with downward flow would appear to possess undoubted advantages over the direct system with upward flow, where the box first in series is exhaustively fouled and then emptied, to be subsequently recharged and placed last in the series. Sulphiding is attended with liberation of water. Sulphuretted hydrogen (H_2S) is oxidized to water (H_2O), and ferric hydrate ($Fe_2O_3xH_2O$) is converted into ferric sulphide (Fe_2S_3) with liberation of water (xH_2O). It was shown in 1915 that a minimum temperature of something like 80° Fahr. (27° C.) would be necessary to enable the crude gas (entering with 1 p.ct. H_2S, and at a temperature 60° Fahr. (15·6° C.)) to carry the whole of the water vapour leaving the sulphiding zone. Condensation is apt to occur in the connecting mains; and the gases entering the second purifier will, in general, be highly charged with moisture in a state of fog.

With an upward flow of gases, the bottom layer of oxide will be markedly lower in temperature than the upper layers. Water separated in the bottom layer of the second box will, therefore, be at a temperature favourable for maximum absorption of ammonia and for its fixation as thiocyanate. Oxide in the upper layers in the second box and in the succeeding box will thus be deprived of ammonia necessary for neutralizing the ferrous sulphate, which is a normal product of reactions in the sulphiding zone; and, under such conditions, re-oxidation of the sulphide by residual oxygen may be retarded, and even inhibited. One has further to remember that, with the direct system as ordinarily worked, the purifier first in series is continued in position until completely fouled. It is then emptied and recharged. Under such conditions of working, the whole of the free ammonia retained by the spent oxide is lost to the system.

With the "backward" system and downward flow of gases, conditions are undoubtedly more favourable for a better distribution of ammonia. Condensed water will descend with the gases; and with it is carried any dissolved ammonia in excess of that required to neutralize the ferrous sulphate produced in the upper layers, and the condensed water and gases finally separate at the point where the temperature is highest and the tension of ammonia at a maximum—conditions favourable for the retention of ammonia in gaseous form for conveyance to the succeeding box. Moreover, the boxes are fouled and discharged far less frequently; and when the purifier last in the series is brought to the first position, the first purifier becomes the second, and the second the third, and any excess of ammonia retained in the oxide is utilized in the new positions.

It is an interesting fact that, since the adoption of the "backward" system at Works "E," a very notable saving has been effected in the amount of ammonia bye-passed to the purifiers. Formerly, in the winter months 15 to 20 grains NH_3 per 100 c.ft. of gas were necessary to maintain the purifiers in working condition, and 2 to 3 grains in the summer months. Tests now show that 1½ to 5 grains suffice. The condensed liquor from the purifiers and connections with the contained ammonia is returned to the scrubbing system. Further details are presented in the next table.

A sample of condensed liquor, collected on Nov. 18, 1918 (inlet gas 62° Fahr., outlet 48° Fahr.), showed "free" NH_3, 0·20 parts per 100; "fixed" NH_3, 0·55; total NH_3, 0·75.

The gases entered and left the system (Oct. 11 to 22) at approximately the same temperature (16·7° C.). Account has only to be taken, therefore, of water produced by the chemical reactions, the whole of which is assumed to have separated as condensed liquor in the boxes and connections.

Then, if x be the per cent. H_2S content of the gas, and y the

Weight of Condensed Water Obtained from the Purifiers and Connections. Oct. 11 to Oct. 22, 1918.

Date.	Water Condensed in Purifiers and Connections.	Temperature of Gas ° Fahr.		Volume of Gas Passed.
		Entering System.	Leaving System.	
	Gallons.			Cubic Feet.
Oct. 11	20·0	65	65	392,000
,, 12	21·5	64	64	382,000
,, 13	26·0	—	—	265,000
,, 14	19·5	61	63	372,000
,, 15	19·0	62	62	396,000
,, 16	20·5	62	62	393,000
,, 17	24·0	62	61	407,000
,, 18	23·0	60	60	430,000
,, 19	25·5	61	60	402,000
,, 20	29·0	—	—	285,000
,, 21	—	61	60	365,000
,, 22	29·5	62	59	375,000
Average per day .	23·4	62 (16·7° C.)	61·6 (16·5° C.)	372,000

water derived from the hydrated oxide—in pounds, the water produced by oxidation of H_2S per day will be—

$$\frac{x}{100}(372{,}000 \times 0{\cdot}9337 \times {\cdot}0502) = x \times 174 \text{ lbs. approx.}$$

and—

$$x\,(174) + y = 234 \text{ lbs.}$$

If we assume that the H_2S content of the gas is 1 p.ct., we have—

$$y = 234 - 174 = 60 \text{ lbs.}$$

Similarly, the weight of ammonia condensed will be—

$$234 \times {\cdot}0075 \times 7000 = 1230 \text{ grains}$$

$$= \frac{1230}{3720} = 0{\cdot}3 \text{ grain } NH_3 \text{ per 100 c.ft. of gas passing.}$$

The ammonia entering the purifiers during this period would be about 2 to 3 grains per 100 c.ft.

The downward flow of gases, further, has a notable effect in reducing back-pressure; and, indeed, it is inadvisable to adopt the "backward system" apart from a reversal of flow. When the gases enter above, tar fog and naphthalene are filtered-out in the top layer where the oxide is most accessible and can readily be raked over, or in extreme cases replaced by fresh oxide. In the bottom layer it is inaccessible; and the effective area of the oxide is further reduced at this critical point of distribution by the material of the grid upon which it is supported.

Apart from the removal of condensed moisture and tar fog, and the better distribution of ammonia, a cyclic "movement" of the boxes tends to a better equalization of hydration conditions in the system, and to the maintenance of conditions *qud* sulphide content and temperature which are favourable to the utilization of residual oxygen in the third and fourth purifiers.

Rise of Temperature a Measure of Work Done.

Passage of the gases through the purifiers is accompanied by chemical reactions which result in fixation of sulphur and rise of temperature. With a purifier in the first position, differences of 10° to 15° C. are not uncommon between the temperature of the oxide in the various layers. With a purifier in the third or fourth position, the rise of temperature from layer to layer is barely noticeable—say, 1° to 2° C.

The question arises, What is the relation between rise of temperature and work done, as measured by make of sulphur? The correct interpretation of temperature data is extremely difficult, as heat liberated by the chemical reactions within the mass is dissipated by radiation losses which vary with atmospheric conditions; and there is further disturbance due to local evaporation and condensation in the boxes and connecting-mains. The sulphuretted hydrogen and oxygen content of the gases, also, are subject to hourly variation; and it is only by multiplying observations over extended periods of working, and by the selection and averaging of data, that a body of facts is finally obtained sufficiently trustworthy to secure a working hypothesis. In the present investigation it was not possible to complete the data by an analysis of the gases entering and leaving the various boxes. It would be of interest to institute comparisons between the oxygen and sulphuretted hydrogen content of the gas with the rise of temperature in the various layers of oxide. Oxidation changes are, no doubt, solely responsible for the slight rise of temperature noticeable in the third and fourth boxes, where sulphuretted hydrogen must be considered absent. It is a matter of uncertainty how far the oxygen is active in the first and second boxes. But experience certainly indicates that the conditions existing there must in general be extremely favourable to concurrent revivification; and one is disposed to attribute the notable variations in temperature that are not infrequently recorded in the first two boxes to varying oxygen content of the gases, rather than to varying content of sulphuretted hydrogen.

For the reasons stated above, no similar relationship could be anticipated between the increase of temperature of the oxide on the various grids and the work there done as measured by make of sulphur. But undoubtedly a rise of temperature in a given layer affords valuable information as to the activity of the oxide

and guidance to the manager who desires to anticipate periods of disorganization. The matter is further discussed in connection with the thermometrical and analytical data presented in tables and graphs that accompany the report.

The purifiers are numbered 1 to 4. The boxes were emptied, refitted internally with the necessary reversing channels, recharged, and again brought into use successively. In the tables are presented data relating to the working of each of the purifiers, from the date of charging to the date of discharge. The average increase of temperature is shown for the various layers in each of the four positions, and likewise the amount of sulphur made, calculated from analytical data furnished by the works chemist, who was also responsible for the sampling. The following example will serve to illustrate the method of calculation applied:

No. 1 purifier, top layer.

Per cent. of sulphur in dried oxide charged . . . 35

" " spent oxide, revivified and dried. . . . . 63·5

Let x be the gain in weight of sulphur per 100 parts of dried oxide charged—

then—

100 parts of oxide charged become $100 + x$ parts on discharge—

and—

$$\text{gain of sulphur } x = \frac{63{\cdot}5}{100}(100 + x) - 35 = 78.$$

Results indicate generally that the make of sulphur decreases as one descends from layer to layer, and that the rise of temperature on the middle layer in all positions is greater than that on the bottom layer. Temperature data are lacking for the upper layer, except in the first position. Results for Purifier 3, however, are anomalous. In this box, the oxide in the middle layer showed little tendency to rise in temperature, whatever the position in series of the purifier, throughout the whole of the working period; while a marked rise of temperature was noticeable on the bottom layer. Judged by the criterion, "rise of temperature," the middle layer of No. 3 purifier must be held to have remained inactive; yet analysis indicates that the make of sulphur in this layer was satisfactory. The attention of the manager was directed to this point at an early date; and he personally satisfied himself that the thermometer tubes were in order and conditions of working uniform. As the matter was one of some importance, samples of the spent oxide from the middle and bottom grids were sent to this laboratory for analysis; but examination failed to detect any material difference in the quality of the products.

The report then gives tables and a graph which relate to average working conditions for the four purifiers. The whole period during which the purifiers were under observation lasted from April 24, 1918, when the last of the four boxes was refitted and brought into action, to Dec. 17, 1918, when the last of the four boxes was cut-out for discharge—a period of 239 days. The graph corresponds to 215 days of this period, and ends on Nov. 25, when the first of the four boxes was cut-out for discharge. This graphic period—April to November—is divided into eight cyclic subperiods, lettered A to H, which vary in length from 58 days (Cycle B) to 5 days (Cycle H). In each cycle each box successively occupied each of the four positions in series; and each position was occupied by one or other of the boxes during the whole cyclic period.

The graph is divided horizontally. In the upper portion the abscissæ denote the position in series, and are lettered I., II., III., IV. The ordinates corresponding thereto denote the average temperature (° C.) of the oxide in the middle layer of the various boxes in various positions. In the lower portion the abscissæ have the same significance as in the upper; but the ordinates here denote the average temperature differences—such average figures being obtained by combining the corresponding average temperature differences for each of the four boxes when in the same position. Ordinates corresponding to the middle layers are connected by a thick black line, and those corresponding to the bottom layers by a thin black line.

We see from the upper portion of the graph that the temperature of the middle layer is at a maximum when the box is in the first position, and at a minimum when in the fourth position. Cycle D is an exception. During this period steam was admitted below the bottom grid of certain of the boxes; and the temperature here reached its maximum with the middle layer in the third position. A marked fall of temperature is apparent in the later cycles. This is attributed in part to the shortening of the cyclic period, and in part to gradual exhaustion of the purifying material.

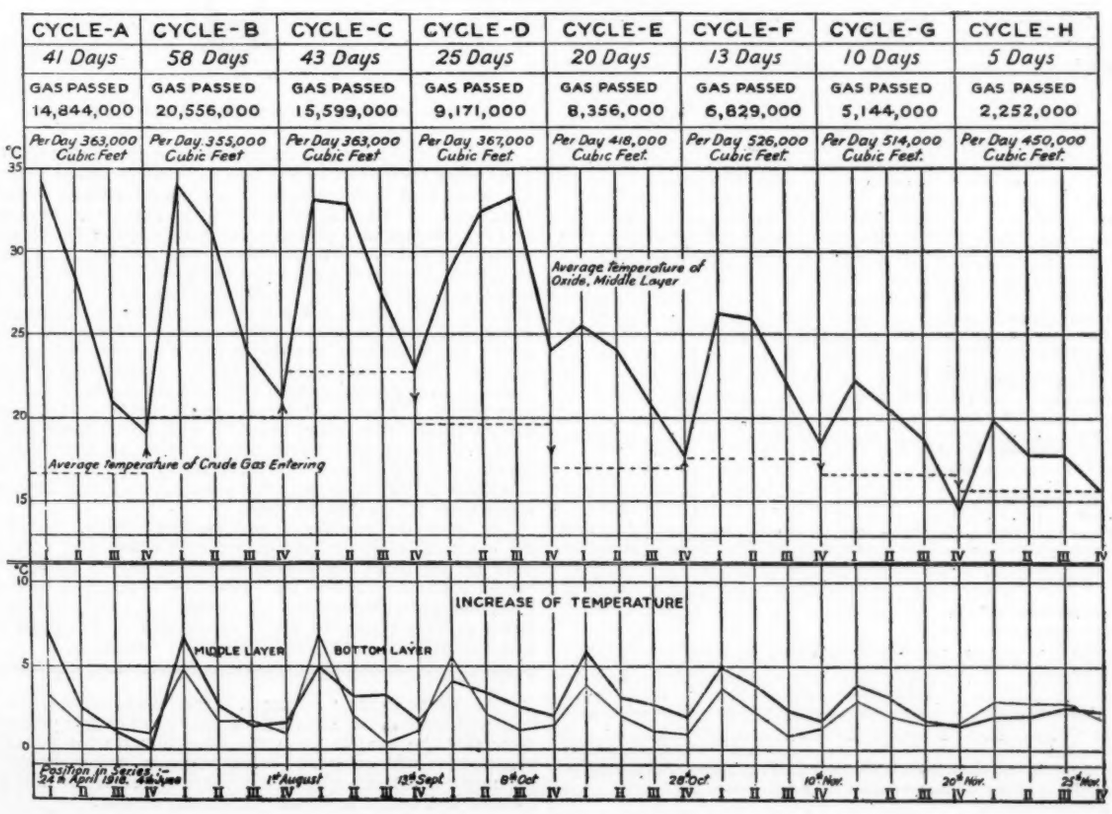
In the lower portion of the graph the cyclic "movement" of the boxes is seen to be accompanied by a marked decrease in activity from the first to the fourth position. It is further seen that the middle layer is, in general, the more active one. For perfect working, the cycles should repeat themselves unchanged; similarity of "curve" indicating complete balance between the sulphiding and oxidation effects within the cycle. Cycles E and F (20 days and 13 days) best indicate the results that might be anticipated under completely satisfactory conditions of normal working.

In Table F an attempt has been made to correlate average temperature differences and average make of sulphur for the different layers in the four boxes. Results are considered to indicate with some degree of certainty that one is justified in attaching great importance to the average temperature difference figures as affording a valuable guide to the progress of the desired reactions on the various grids.

AVERAGE RESULTS—FOUR PURIFIERS.

215 DAYS,

GAS PASSED—82,751,000 C.FT.



It was anticipated that, by shortening the cyclic period, the temperature of the last two purifiers would be raised relatively to that of the first two purifiers, and that the temperature of the exit gas would be raised relatively to that of the entering gas. The data presented in Table F, however, are by no means conclusive on this point, as it is impossible to decide how far the temperature changes are due to the shortening of the cyclic period in view of the progressive decrease in activity of the oxide.

With Cycle A (41 days) the average temperature of the first two boxes (all layers) was 30·8° C., and that of the last two boxes 20° C.; a difference of 10·8° C. With Cycle F (13 days) the average temperatures were 25·9° C. and 19·4° C. respectively, and the difference 6·5° C. A fall of temperature in the first two boxes of 4·9° C. thus left the temperature of the last two boxes practically unchanged; but the advantages of shortening the cyclic period are not apparent from a consideration of the data relating to the temperature of the gases entering and leaving the system. Thus, with Cycle A gases enter at 16·9° C. and leave at 19·9° C.; a difference of + 3° C. For Cycle F the difference was 2·1° C. This reduced temperature difference is a disadvantage in a purifier system working with the "direct" process, as there is here a tendency to accumulation of water within the system owing to the relatively high temperature of the "bubbler."

Data are lacking to determine the cyclic period corresponding to maximum efficiency; but a medium period (say) one of fifteen to twenty days, is favoured as calculated to secure a better distribution of ammonia and moisture than one of forty to fifty days.

TABLE E.—*Average Results for Four Purifiers. April 24 to Dec. 17, 1918 (239 days).*

—	Position of Purifier in Series.				Remarks.
	First.	Second.	Third.	Fourth.	
Period under observation Days	223	226	222	217	—
Average temperature of middle layer of oxide °C.	31·2	29·3	24·2	20·4	24th April—25th Nov.
Average temperature of gas entering top layer °C.	19·2	18·3	19·2	19·4	Average 19·1
Average increase of temperature of oxide in each layer over that of oxide in preceding layer:					
Top layer . . .	6·2*	—	—	—	—
Middle layer. . .	5·9	2·8	1·9	1·7	—
Bottom layer . .	5·0	2·0	1·3	1·1	—

* Excess temperature over that of entering crude gas.

Work Done by Oxide on the Various Layers, as Measured by

Layer.	Sulphur Made per 100 Parts of Oxide Charged (Dried).		Rise of Temperature. ° C. Average for Four Purifiers in			
	Average for the Four Purifiers.		First Position.		Second Position.	
		Relation*		Relation*		Relation*
Top	83·5	1·85	6·2	1·25	..	..
Middle . . .	58·0	1·3	5·9	1·2	2·8	1·4
Bottom . . .	45·5	1	5·0	1	2·0	1

* Bottom layer = 1.

TABLE F.

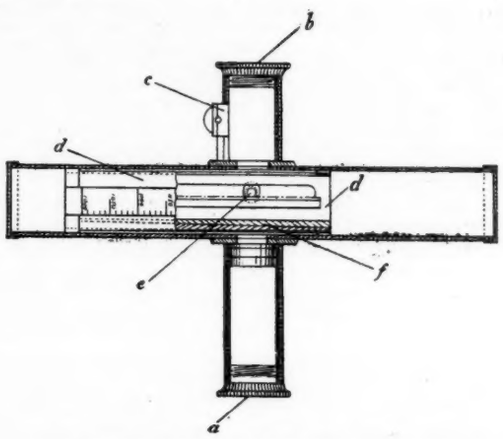
	Cyc'e.							
	A.	B.	C.	D.	E.	F.	G.	H.
Period	41	58	43	25	20	13	10	5
Steam circulated below grid—								
Bottom of each purifier . . . . Days	*Nil*	*Nil*	*Nil*	2	*Nil*	*Nil*	*Nil*	*Nil*
Bottom of first purifier only . . . . Days				2				
Bottom of second purifier only . . . Days				9 (23)				
Bottom of third purifier only . . . . Days				6				
Bottom of fourth purifier only . . . . Days				4				
Average temperature, all layers. . . . °C.								
First two purifiers . .	30·8	32·0	33·2	30·9	24·4	25·9	21·3	19·4
Second two purifiers .	20·0	22·2	24·0	28·3	18·5	19·4	16·5	16·7
Difference . . .	10·8	9·8	9·2	2·6*	5·9	6·5	4·8	2·7
Average temperature . °C.								
Crude gas entering first purifier	16·9	19·9	22·3	19·7	16 9	17·4	16·6	15·7
Crude gas leaving last purifier	19·9	22·1	25·7	25·4	18·3	19·5	15·9	17·8
Difference . . .	+3·0	+2·2	+3·4	+5·7*	+1·4	+2·1	−0·7	+2·1

* The effect of steam is seen in the rise of temperature of the third and fourth boxes, since steam circulated below the bottom grid of No. 2 box (or No. 3) would be instrumental in raising the temperature of the gases entering No. 3 box (or No. 4) with downward flow.

THE "WEDGE" OPTICAL PYROMETER.

A new and greatly improved model of their "Wedge" Optical Pyrometer has just been brought out by the Optical Pyrometer Syndicate, of Audrey House, Ely Place, London, E.C. 1. This pyrometer was first introduced early in 1917, and has since come into considerable use as an accurate and portable instrument for measuring furnace temperatures. Practical work has, however, shown that improvements were possible, and these have been embodied in the 1919 model.

The "Wedge" pyrometer consists essentially of a rectangular brass tube, 9 in. long, across which is fitted a small telescope. The brass tube contains a wedge of dark red glass, which can be moved through the field of vision of the telescope by means of a rack-and-pinion. The telescope is pointed at the heated body or furnace aperture, the image of which is viewed focussed on the dark wedge. The wedge is then moved so as to bring a greater and greater thickness of glass in front of the eye. The image gradually fades into invisibility; and when the last ray of light is shut-out, the temperature is read on the scale provided. It is claimed that the "personal equation," after a little practice, will cause a difference between observers of not more than 10°; and the pyrometer, having been calibrated under "black body" conditions, should read "black body" temperatures to within this limit of error.



Plan, Showing Details, of the "Wedge" Pyrometer.

In its original form, the instrument was open to certain objections which the makers believe they have now completely obviated. The small field of the telescope made it hard to find a small aperture, and easy to lose it when found; so that errors were caused by the disappearance of the object being due to its getting out of the field of vision. The instrument was also trying to the eyesight when used very much; and the glass of which the wedge was made, owing to war conditions, often left something to be desired. The telescope has now been much improved, given a wider field, and furnished with a rackwork focussing arrangement; and it has been possible to find much better glass for the wedges. The strain on the eye has been eliminated by the provision of an eye-screen, which allows of the disengaged eye being kept open. The result of these improvements is that readings can be taken, after some practice, with great speed and confidence. The smallness and portability of the instrument, the simplicity and quickness of its working, its accuracy, and the impossibility of its developing unsuspected errors, offer advantages which place it in a class by itself.

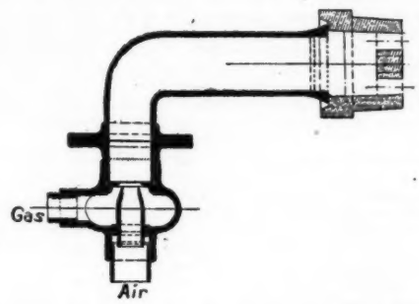
The annexed figure shows the pyrometer in plan. In this, *a* is the eye-piece of the telescope, *b* the objective, and *c* the rackwork for focussing the telescope on the heated object. The carrier *d* mounted inside the brass tube is actuated by a rack-and-pinion *e*, and carries two glass wedges *f*. One is the essential wedge of dark glass; the other, fitting into it, is of plain glass, and is introduced to correct the effects of refraction.

According to the "Engineer," experiments made in Switzerland with mixtures of acetylene and coal gas in equal proportions show that the mixture gives the same illuminating power as a combination with oil gas. The experiments further showed that this mixture of gases may be put under a pressure of nine atmospheres, and heated up to 100° C. without danger.

THE INFLUENCE OF THE BURNER IN INDUSTRIAL GAS HEATING.

Under this title, M. Grebel presented to the Société Technique some comparative results obtained by heating the same furnace, for the thermal treatment of metals with two different burners.

First a burner of the ordinary type was used, formed of concentric tubes, in which air is supplied under pressure through the centre tube. In the second instance he used a special burner made by "Air et Feu," of Argenteuil, as shown in the accompanying diagram. In it is realized as complete a mixture as possible of the gas at a normal pressure of 60 mm. (2·36 in.) water column, and the air supplied at 30 cm. (11·81 in.). Also a very homogeneous, short, and hot flame is obtained, and any air currents which ordinarily may escape combustion are prevented from passing through the furnace with the burnt gases. These results are achieved: (1) By enlarging the mixing chamber after the gas and air inlets. (2) By a right-angled elbow. (3) By two perforated discs. (4) By a nozzle of refractory material of special shape, which prevents the flame from lighting-back.



The furnace, which was set-up for cementation at temperatures below 1650° Fahr., was, in the experiments quoted, heated empty by three burners so as to obtain temperatures varying from 932° to 2192°. The dimensions were 31·5 in. by 15·7 in. by 11·8 in. The results obtained are summarized in the following table. The first of each pair of results is with an ordinary burner, the second with the special burner described above.

Furnace Temperature Maintained.	Barometer.	Temperature of Outside Air.	Temperature of Combustion Products Leaving Furnace.	Analysis of Combustion Products.		Gas Consumption per Hour.
° Fahr.		° Fahr.	° Fahr.	CO.	CO_2.	C.Ft.
932	—	—	311	13	3	127
	29·9	52	230	12	3	92
1292	29·2	50	324	12	4	170
	29·4	55	324	12	4	109
1472	29·5	50	349	10	6	233
	29·1	56	320	11	4·5	159
1652	29·5	52	460	11	5	328
	29·1	57	464	12	4	198
1832	29·6	45	582	7	7	420
	29·5	57	608	8·5	5·5	240
2012	29·5	45	647	6	8	445
	30·0	57	652	8	6	290
2192	29·4	52	761	6	7	529
	29·7	55	773	7	7	356

In all of the above cases the air was supplied at a pressure of 11·4 in. water column, and the gas at 2·4 in. In no case was pure oxygen found in the products of combustion. From the above results, M. Grebel deduced an average economy in favour of the new burner of 40 p.ct.

In most cases of the thermal treatment of metals, the best results are obtained, in the opinion of the author, by the use of a combustion which is, if not reducing, at any rate "neutral." Thus it is that in autogenous soldering, where the products of combustion are not diluted in the nitrogen, and where the temperature realized is very high, only half the quantity of oxygen theoretically required is supplied to the acetylene, hydrogen, or town gas, as the case may be. When relatively high temperatures are required in a furnace, recourse is generally had to a slightly reducing combustion. In the experiments detailed above, for instance, only 80 to 85 p.ct. of the air necessary for complete combustion was used. This can be explained by the fact that the heat in the furnace is relatively increased by the reduction in the amount of heat carried off by the products of combustion, and that the flame is hotter with a slightly reducing combustion.

The abstract notion of the "combustion temperature," or the theoretical temperature of the flame, is apt to lead to deceptive interpretations, as its calculation is based on the hypothesis that the reactions are not retarded, that the heat of reaction serves only to heat the products of combustion, and that the phenomena of dissociation do not enter into the question. Now, flames do not develop within adiabatic limits. They are themselves non-homogeneous, non-isothermic media, in which are produced progressive oxidation and more or less rapid and contrary dissociation. It can well be imagined that the speed of the reactions, by reducing the volume of the flames, may considerably vary the actual and measurable temperatures of the various points of the flame. It is known that the uniform initial speed of propagation of the flame is, all things being equal, at a maximum for a mixture of gas and air containing about 80 to 85 p.ct. of the necessary air. This maximum speed is 25 to 30 p.ct. above that of the mixture corresponding to perfect combustion. The beneficial influence of this increase in the speed of propagation of the flame, which is often explained by a better conductivity of the mixture, is capable of raising the temperature by much more than the 80° C. which theoretically separate combustions with 100 and 90 p.ct. respectively of the necessary air, and the 130° C. for 90 and 77 p.ct. In any case, it is a fact proved in practice that the highest results in lighting, heating, and power can be obtained by a slightly reducing combustion. The most economical combustion varies in relation to complete combustion according to the way in which the products are drawn off, and according to local temperatures.

Regulation of combustion is therefore of the first importance, and it was to make it more easy that M. Grebel studied out the comburimeter, which he introduced to the Société Technique in 1912 [see "JOURNAL," Vol. CXIX., p. 44], and which indicates the quantity of air necessary for the complete combustion of any gas.

SYNTHETIC AMMONIA AND ITS POSSIBLE ECONOMIC RESULTS.

An abstract appears in the "Technical Supplement" of an article contributed to the "Comptes Rendus" by M. G. Claude, on the subject of synthetic ammonia and its possible economic results.

The author describes results obtained by him after two years of research, which should be of great advantage when applied to the direct synthetic production of ammonia. He believes that the results have not previously been known. In times of peace the chief object of the fixation of nitrogen is for the production of fertilizers. A process which produces ammonia should, therefore, be completed by some method of combining the ammonia, which is not easily transportable, into some product easily portable and of service directly as a fertilizer. With the exception of the transformation into nitrate, which is the most rational method, the only means yet considered either for ammonia produced from cyanamide, or that resulting from direct synthesis, is the classic transformation into the sulphate. But this needs enormous quantities of expensive sulphuric acid, which has no value as a fertilizer. Only in Germany has attention been given to a French process for lessening the cost of transport by obtaining the necessary sulphuric acid from gypsum. If one can credit the statements made by German engineers, it was on these lines that they were working.

However, the sulphate of ammonia is not the only salt capable of use as a fertilizer. The research of Georges Ville proved that the chloride is at least as valuable, while its smaller weight for a given volume of contained nitrogen renders its transport cheaper. It is suggested, therefore, to produce chloride of ammonium synthetically. If this only means that hydrochloric acid would be substituted for sulphuric acid, the result would be of secondary importance; but it is quite otherwise. In the manufacture of soda by the ammonia process, a given quantity of ammonia transforms indefinite quantities of sea salt and of carbonic acid into carbonate of soda. The chlorine of the sea salt combining at first with the ammonia, is, after the regeneration of the latter by lime, transformed into chloride of calcium, which is lost. But if by the synthetic process indefinite volumes of ammonia were available instead of merely a given volume, which had to be regenerated and re-used, the process could be stopped at the production of chloride of ammonium and bicarbonate of soda. The desired end would then have been attained—to transform the ammonia into an easily portable form which can be used as a fertilizer, but by means of the chlorine of sea salt, instead of sulphuric acid. The present bye-product, chloride of calcium, would not be produced; and for each ton of nitrogen fixed there would result 3 tons of carbonate of soda as a bye-product.

Handling of Traffic in London.—The procedure has been arranged for the Committee (of which Sir James Fortescue Flannery is Chairman) appointed to investigate Mr. A. W. Gattie's proposal for improving the method of handling goods and traffic, and to consider the practicability of the introduction of any of the suggested improvements into existing transport systems. Some particulars of Mr. Gattie's scheme were given in the "JOURNAL" for Feb. 4 last [p. 226]. The first meeting of the Committee is to be on the 20th inst.

Temporary Increase of Charges Act.—An Order under the Statutory Undertakings (Temporary Increase of Charges) Act has been made by the Ministry of Health, authorizing the Borough of Tiverton to increase the charge for gas from 4s. 6d. to 5s. 6d. per 1000 c.ft. The Gas Light and Coke Company notify that they have made application to the Board of Trade for an Order. The Ministry of Health have also received applications from the Cowes Urban District Council, the Oldbury Urban District Council, and the Smethwick Corporation.

WATER GAS BY "STEAMING" AT FRANKFURT.

According to the "Technical Supplement," quoting from an article in the "Journal für Gasbeleuchtung," the old-type retort-benches in the Frankfurt Gas-Works have been changed at a comparatively low cost into modern and very profitable water-gas retorts, about 14 ft. 9 in. long, arranged with openings at both ends, and filled and emptied automatically by machinery. They are coke fired with ladder grates, and the flue-gases generate steam in cylindrical fire-tube boilers fixed in the flues; about 7700 gallons of water being evaporated per 24 hours into steam, at a pressure of 7·5 lbs. per sq. in. The steam thus produced is blown into the retorts to form water gas instead of ordinary coal gas. The volume of gas produced is greatly increased, without any noticeable decrease in the quantity of coke, tar, ammonia, and other bye-products.

The normal output of gas from the dry retorts was 127,500 c.ft. per 24 hours. This is now increased to 147,000 c.ft. by steam injection. The quantity of coal used is the same in both cases—3 tons 13¼ cwt. The following analysis of the gas is the mean of a four days' trial:

	Water Gas. P.Ct.		Ordinary Gas. P.Ct.
Carbonic acid gas	5·0	..	3·2
Heavy hydrocarbons	2·6	..	3·7
Carbonic oxide	10·0	..	8·3
Hydrogen	51·2	..	48·6
Methane	25·6	..	31·0
Nitrogen	5·6	..	5·2

The heating value of the water gas is about 11·5 p.ct. higher than that of the ordinary gas, and the specific weight 0·159 compared with 0·490.

A RECORDING METER FOR DISSATISFIED GAS CONSUMERS.

A way of dealing with complaints of excessive charges for gas, by the use of a recording meter fixed on the premises and in tandem with the ordinary meter, is described by Mr. Chas. L. Barrett in the "Pacific Service Magazine." If gas is used exclusively for lighting, the consumer does not always appreciate the fact that the hours of darkness (6 a.m. and 10 p.m.) vary during the year from two in June to seven-and-a-half in December, and from this cause alone the consumption of gas may be expected to vary in like proportion. If arguments on this line are not effectual, the official meter test is little more use; but the plan here described, which has the advantage of being carried out on the premises and in conjuction with the regular consumption, has proved satisfactory.

In addition to the usual dial mechanism, the recording meter comprises a cylinder carrying a chart divided into hour spaces, revolved by clockwork, similar to that in an ordinary pressure recorder. The pen marks a small vertical stroke at the exact time of each complete revolution of the meter, as shown by the test dial, from which the hourly rate of consumption can be calculated; and the recording meter, being continually under test for correctness, indicates any faulty registration of the regular meter during the test period, which may cover five or six days. The results are entered on a form ruled for hour and day consumption, and a copy is supplied to the consumer, who is thus able to compare the consumption with the actual working conditions. With very few exceptions the information is satisfactory, provided the regular meter is not at fault.

The arrangement may also be used for testing the soundness of the house fittings, the quantity of gas used by any individual appliance, or for taking out separate costs of lighting, heating, cooking, &c.

American Gas Association and Publicity.

Addressing a meeting held in New York in connection with the Advertising Section of the American Gas Association, Mr. George B. Cortelyou (the President of the Association) said he felt sure there would be no difference of opinion as to the necessity for regarding a well formulated and thoroughly well carried out scheme of national advertising and publicity as among those features of co-ordination essential to the life and the progress of the Association. Mr. George Williams, new Business Manager for the Henry L. Doherty & Co. public utility interests, has been elected Chairman of the Section; and Mr. Herbert K. Dodson, Commercial Manager for the Consolidated Gas, Electric Light, and Power Company of Baltimore, Vice-Chairman. To these two officers has been entrusted the selection of a Managing Committee, to consist of nine members, who, with the ex-officio members provided by the Association's constitution, will appoint a Secretary for the section. The wish was expressed that the membership of the Governing Committee should be divided equally, as far as possible, between the east and west portions of the country, so that full representation of the entire gas industry may be assured in the Publicity Section's activities. The Natural Gas Association of America have also started an active campaign for the promotion of publicity in the communities that are served by natural gas.

CORRESPONDENCE.

[*We are not responsible for opinions expressed by Correspondents.*]

Further Parting of the Ways.

SIR,—The report of the South Metropolitan Gas Company to which your leader is addressed strikes me as sounding an alarm for all who, like myself, are aiming at meeting a great and increasing demand for gas as a cheap fuel, and who have advanced considerably on that road, so that we have now the highest scientific authorities pointing out by how far we have already distanced electric and other competitors.

I cannot think that the South Metropolitan Company can have considered for a moment what must inevitably be the reflex operation of their policy upon, first, their immediate neighbours, and, second, upon the country at large; for I pledge what value my long experience may be worth that none of us have the physical means of "accepting the [Beilby] report in its entirety." Neither in inerts nor in sulphur purification have we the means possessed by the Company which, for a long time past, has worked up a unique process for sulphur, and has excluded water gas entirely.

Again the charging for gas by its electrical equivalents in thermal energy imports a needless, almost fantastic, variation into our long-established system of charging for our products, which would be as expensive to us as it would be puzzling to our consumers. I say this last because, if a certain standard is maintained, and secured by proper controls, it is much simpler to have a footnote to the consumer's bill stating what the standard is, and how many electrical equivalents the penny represents at the price charged per 1000 c.ft. What earthly need is there for calculating the value back from gas to the basis and forward again to the electrical equivalent? The whole thing is a retrogression.

Are we to substitute for the well-valued and simple provision we are now making, of gas of about 480 B.Th.U. per cubic foot at the lowest price consistent with a dividend charge (seldom exceeding 6d. per 1000 c.ft.), a new-fangled fancy article at a fancy price? Let there be no mistake, the restriction to so low a standard of inerts and to sulphur limitation cannot be effected without extra costs, which will represent more to the consumer than they are worth.

Nobody wants them but such scientists who do not realize our work, or how great a boon the present gas fuel is. It has defied restriction in the slot meters for the past year. It has saved the country through Lord Moulton; we have carried on through this horrible war without profiteering; and it is almost wicked to deny us financial relief, unless we accept another yoke, and an unnecessarily fantastic one at that.

Since my paper of 1902, to the former Institution of Gas Engineers, in which I foreshadowed the "Gas of the Future" to be a fuel of a cheap kind, capable of heating, power, and lighting at a low cost of production and of capital, I have sought no other end; and I mean for my own part to fight to the last for taking-off fetters and for enlarging the scope of usefulness by cheapening the production to meet the man who wants all services without waste or a smoky chimney.

What I hoped for in 1902 has been already accomplished. Witness eminent scientists like Lord Moulton, Sir Dugald Clerk, Professors Smithers, Cobb, and Bone, and others. Why seek to frustrate us? Why not rather make a crusade against the inerts we groan under in our coals?

I hope no one will follow this "unfortunate lead," which I regret beyond measure, feeling bound to oppose in all conscience.

13, *Queen Anne's Gate, S.W.*
Aug. 9, 1919.

HY. E. JONES.

Tar Distillation Profits.

SIR,—In your issue dated Aug. 5, under the heading of "Tar Distillation by Gas Undertakings—Burnley's Profitable Results," I notice that the net receipts for tar are given as £5756, that 3180 tons of tar were distilled, and that "the net receipts for tar were therefore equal to 41s. 6d. per ton." I make £5756 divided by 3180 to be equal to 36s. 2d. per ton.

You publish monthly in your "JOURNAL," under the heading "Manchester District Tar Prices," the average price realized for tar in the Manchester district, based on the value of products; and these prices, over the same period as that covered by the Burnley figures, average 41s. 9d. per ton.

Aug. 9, 1919.

INTERESTED.

[The figures referred to were taken from Mr. Leather's printed report.—ED. "G.J."]

REGISTER OF PATENTS.

Gasifying Combustible Carbon Matter.—No. 121,124.

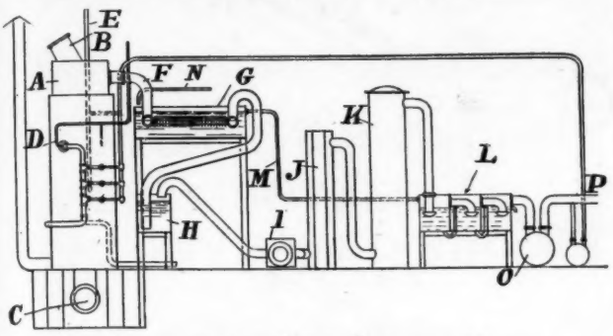
COLSON, L., of Paris.

No. 19,378; Nov. 25, 1918. Convention date, Nov. 26, 1917.

The object of this invention is to provide apparatus which "completely gasifies all combustible carbon matter by the action of steam in the presence of lime at a suitable temperature under the best conditions for economical and industrial yield."

In a brickwork furnace is placed a retort A, of cast iron or refractory material, arranged vertically or obliquely. The retort is charged with a mixture of coal and lime through an aperture B at its upper part. After gasification by the steam, the residues are discharged through an opening C at the lower part. The furnace is heated during the first part of the operation by heavy oil burners D or by gases from a gas generating plant. The heating is carried sufficiently far to obtain a temperature between 700° and 1200° C. When the required temperature has been obtained, steam is injected into the mass contained

in the retort and gasification occurs. Steam enters by a perforated tube E, the lower extremity of which is at the lower zone of the burners. The gases coming from the retort by a pipe F pass into a worm provided with gills arranged in a tank G containing a solution of bicarbonate of potash, to which they give up part of their heat.



A French Plant for Gasifying Carbonaceous Matter.

This de-bicarbonizer contains bicarbonate, which is brought to the condition of neutral carbonate in consequence of the rise of temperature of the solution of bicarbonate under the influence of the hot gas passing in the tubes forming the worm. After the tank there is an apparatus H forming a hydraulic joint preventing the return of any gas to the retort during charging. A pump I draws the gas from the retort and forces it through the apparatus, and a cooling device J reduces the temperature so as to allow of the absorption of the ammonia.

The ammonia gas present in the gaseous products coming from the retort is absorbed in the tower K, "which allows it to be retained either in aqueous solution or in the condition of sulphate of ammonia if a solution of sulphuric acid is placed in the absorbing apparatus."

The gas coming from K passes into an arrangement L, in which it is freed from its carbonic acid. This arrangement consists of a series of pipes causing the gas to pass into a solution of neutral carbonate of potassium.

The solution, when it is saturated with carbonic acid, is sent to the tank G by a pipe M in order to be de-bicarbonized under the action of the heat of the gases coming from the retort or other suitable source. When the de-bicarbonization has taken place, the solution of neutral carbonate returns from the tank G to the apparatus L, to serve for a new absorption of carbonic acid. This return is effected by the pipe O. The purified gas traverses a meter O, before it is lead away by a pipe P.

Heat-Recuperators for Air or Gas.—No. 122,396.

SOCIÉTÉ FRANCO-BELGE DE FOURS A COKE, of Brussels.

No. 17,388; Oct. 24, 1918. Convention date, Jan. 17, 1918.

This heat-recuperator for air or gas is formed of fire-clay and allows an exchange of heat to take place between two gaseous or fluid currents. The invention involves the use of bricks having vertical channels so shaped that, by their juxtaposition, horizontal channels are formed. In this way, there is obtained a recuperator constructed of simple bricks capable of great output and of greater air-tightness than usual, owing to the care given to the preparation of the junctions. What the patentees claim is: (1) A heat-recuperator for air or gas consisting of a plurality of bricks of uniform design with gas-tight joints and having vents forming (when assembled) a vertical circuit, which is cut by horizontal joints absolutely gas-tight, and a second circuit which is horizontal formed by lateral depressions at each side of the bricks and having vertical joints covered by jointing elements. (2) A brick for heat-recuperators having a vertical vent or vents of small section passing through its longitudinal axis, and lateral depressions at each side, adapted (when the bricks are juxtaposed) to form horizontal channels of larger section than the vents.

Destructive Distillation of Carbonaceous Materials to Increase the Aromatic Bye-Products.—No. 128,660.

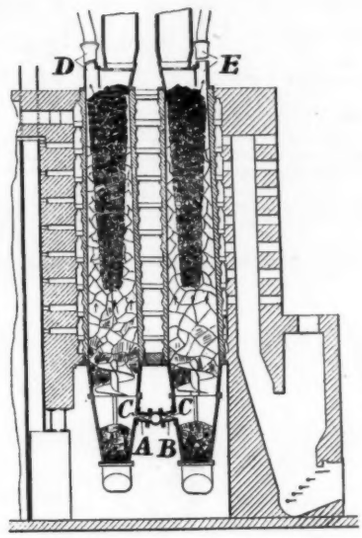
PERKIN, F. M., of New Oxford Street, W.C., and NITROGEN PRODUCTS AND CARBIDE COMPANY, LTD., of Old Broad Street, E.C.

No. 12,350; Aug. 28, 1918.

This invention, relating to the destructive distillation at high temperature of carbonaceous material, more particularly refers to the continuous carbonization of coal in vertical retorts, the subject of patent No. 114,937. A process is there described consisting in expediting the heating-up of the coal charge so as to reduce the period of low-temperature distillation to a minimum, by causing inert gas to travel upwards through the red-hot coke in the lower portion of the retort, where the gas becomes highly heated, then through the partially coked mass of coal which removes the volatile matter, and finally through the coal which has received its first heat in the hot zone of the retort. Here the inert gas gives up some of its heat; but, owing to its rapid rate of travel, it is not sufficiently cooled to cause excessive condensation of the volatile matter on the coal. The whole of the gas and distillates are then withdrawn from the retort by the gas take-off.

It was claimed in the patent in question that an increase in tar per ton of coal was produced by passing a portion of gas made by the distillation of the coal (after it had been stripped of its condensable constituents) back through the charge in the retort; while in a prior process for the distillation of coal and the like by successive carbonization, it has been proposed to pass gas and steam through the retort during the distillation process for the purpose of assisting in the conversion into benzol of the acetylene which is stated to be formed during one stage of the distillation process.

The present invention consists in a process where an inert gas is passed through the retort, according to which the inert gas is mixed with acetylene gas and the mixture then passed into and through the retort, whereby a final tar product is obtained in which the benzoloid content is increased.



Perkin's Continuous Carbonization Process.

The illustration shows a pair of retorts in sectional elevation. It is preferred to use a mixture of stripped gas and acetylene gas led, by pipes A B, into the lower end C, of the charged and heated vertical retorts through the red-hot coke, where the acetylene becomes polymerized into the benzol and other hydrocarbons of the aromatic series, and finally drawn off at the gas outlets D E. By the term "stripped gas," the patentees wish it to be understood, "a portion of the gas produced in the same retort in the usual way, and which, after it has been stripped of its condensable constituents, is led back to the retort mixed with acetylene gas."

The mixed gas may be led into the retort at a pressure depending upon the temperature existing in the retort or other circumstances of working. The proportion of acetylene to stripped gas may be variable and range from 2·5 to 10 p.ct., depending upon the temperature to which the retort is heated, and the speed of passing the gas. Owing to the dilution of the acetylene with the stripped gas, it has been found that the conversion of acetylene into benzol is more complete than if pure acetylene gas is passed through the retort.

Carbonizing or Distillation Apparatus.—No. 124,015.

FREEMAN, N. H., of St. Andrew's Mansions, Dorset Street, W.

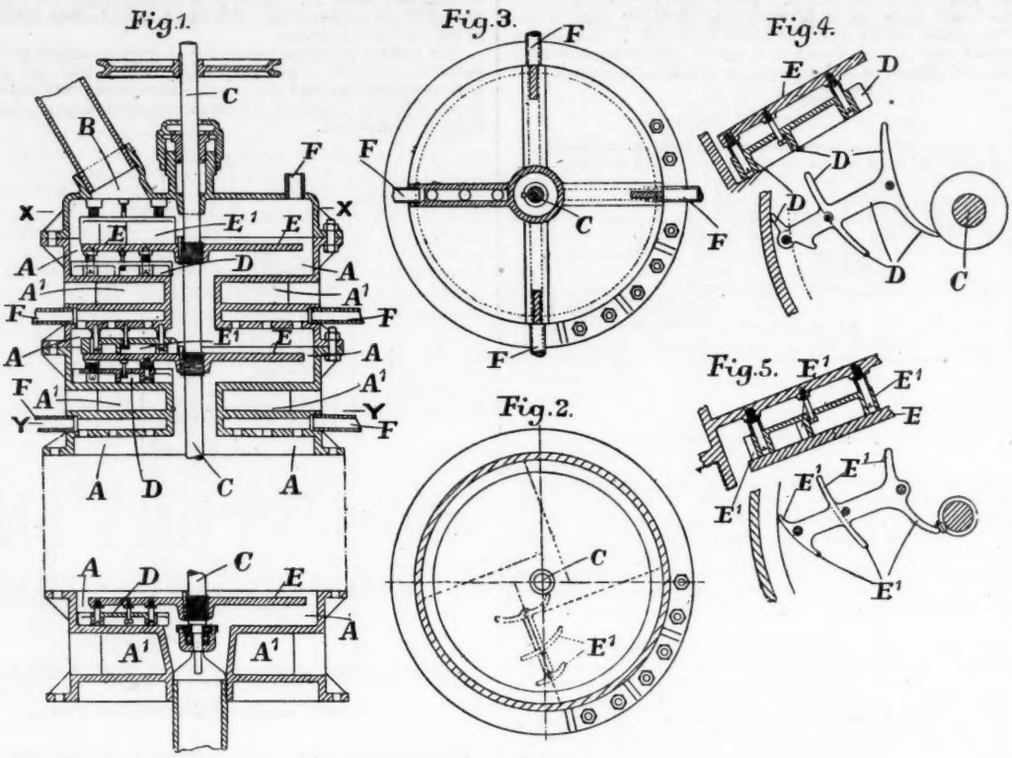
No. 2462; Feb. 12, 1918.

This invention relates to apparatus in which the material is passed zig-zag through a series of superposed compartments by means of stirrers or scrapers—each compartment heated separately in a controllable manner.

The patentee remarks that in a known circular retort—consisting of a chamber provided with a number of plates placed above each other and mounted alternately on a central revolving shaft and on the casing—the material admitted on to the uppermost revolving plate is gradually scraped off by deflecting plates hinged to the cover of the chamber and allowed to fall on to the next lower fixed plate, and so on through the chamber. According to the present invention, each successive chamber is provided with a centrally disposed rotary platform for receiving the coal, over which platform the material, when entering the chamber, is caused to move in one direction by stationary shoes or deflectors, while similar shoes or deflectors carried by the platform on the opposite side feed the material in the reverse direction to the outlet of the chamber. The chambers are so constructed and arranged as to afford an independent annular heating chamber between each pair of adjoining carbonizing chambers; and means are provided to conduct the gaseous products away separately from each chamber.

Fig. 1 [next page] is a vertical section of the apparatus. Fig. 2 is a sectional plan on the line X, showing in dotted lines the relative position of certain of the shoes. Fig. 3 is a sectional plan on the line Y of fig. 1. Figs. 4 and 5 are illustrative of details.

The chambers A (of which there may be any number) are preferably arranged in tiers; the coal being fed through an opening B at the top and caused to pass around and through each chamber. From the first (upper) chamber the coal enters the second chamber at a central point, and, after having moved towards the periphery of the chamber and back again to the centre, it enters the next (third) chamber, and so on through the several chambers. The chambers are disposed concentric to a vertical shaft C, which is adapted to be rotated by a pulley above; while within each chamber is provided a series of blades, vanes, or shoes D carried by a rotary platform E (figs. 1 and 4), keyed to the shaft for directing and conducting the coal during its passage through each chamber. These shoes (of which there may be any number, arranged in any appropriate manner), when rotated within the chamber, agitate and feed the coal from one chamber to another so as "to



Freeman's Coal Distillation Plant.

permit of the bye-products being separated therefrom." In addition to the revolving shoes, fixed shoes E^1 (figs. 1 and 5) deflect the coal, and cause it to fall over the edges of the rotary platform. In the latter connection, the rotary platform or table will also carry the coal into contact with the shoes E^1—"being designed to effect the feeding of the coal in the desired direction and at the required rate." Each chamber is provided with an outlet F, whereby the distillation products separated during the passage of the coal through each chamber may be drawn off. Between each adjoining pair of chambers are annular chambers A^1, into which gaseous fuel burners may be inserted to permit of the heating of each chamber A in such a manner that the temperatures may be regulated as required.

The means for controlling the temperature may be of the type in which a body of mercury is caused to close an electrical circuit for actuating means to reduce the temperature, as described in patent No. 120,590.

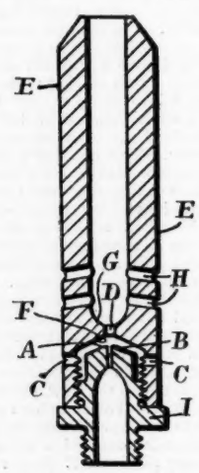
[This arrangement was incidentally alluded to in the "JOURNAL" last week, pp. 280, 286.]

Gas-Heating Burners.—No. 129,050.

HUNTER, J., of Barrow-in-Furness.

No. 5908; June 1, 1918.

This invention has reference to burners for domestic heating, cooking, and ironing, also for soldering and other purposes; the object being to provide a burner wherein the danger of back-firing is largely overcome.



Hunter's Gas-Heating Burner.

The burner is made in two parts. One part consists of the burner tube E, at the bottom of which is the chamber B and the contracted axial aperture or nozzle D, having a flaring entrance F with sides converging towards the nozzle, while the other side G of the nozzle is flared in the opposite direction, so that its sides diverge towards the sides of the burner tube E. The lower part of this burner above the nozzle is perforated at H for the admission of air; and the chamber B at the lower part of the burner tube has perforations C for the admission of air, so that the gas becomes charged with air before and after it passes through the nozzle. The other part of the burner consists of a nipple I provided with a contracted nozzle A, which enters the flaring mouth F, being screwed into the gas service pipe or into a tubular fitting. The inclination of the flaring entrance F is such that the angle formed at its junction with the nozzle D is between 115° and 120°; and the nozzle A, which projects up into proximity with the entrance F, is chamfered exteriorily at the top, so that the angle of the chamfer and the angle of the flaring entrance substantially correspond but leave a small space between. Thus the gas emerging from the nozzle A draws in air through the perforations in the chamber, on the principle of an injector, but causes the air to be thrown laterally over the jet of gas; the object being "to thoroughly mingle the air with the gas, increase the volume of the latter, and add to the lightness of the mixture," so that it is supplied to the burner under sufficient pressure to prevent back-firing. Furthermore, as the nozzle A projects into proximity with the flaring mouth F, the gas issuing from it and the air entering through the perforations C do not merge into a chamber of any considerable capacity, and cannot expand to such an extent as to lose pressure.

Alkali-Fusion of Aromatic Sulphonic Acids.—No. 129,002.

SOUTH METROPOLITAN GAS COMPANY and EVANS, E. V., of Old Kent Road, S.E.

No. 13,314; Sept. 17, 1917.

This invention is particularly applicable to the manufacture of phenol, naphthols, or the like from the corresponding sulphonic acids by fusion with caustic soda, when the latter is not readily obtainable.

As a specific example of the invention, 100 kilos of the usual melt made by fusing benzene monosulphonic acid with caustic soda are treated with 90 litres of water, and the solution drawn off from the sludge, The latter is transferred to an electrolytic cell in such quantity as to maintain the liquor (containing sodium sulphate as a product of the electrolytic action) undergoing electrolysis therein at such strength that it is throughout saturated with sodium sulphate—the solid sodium sulphate in the sludge remaining undissolved. The sulphite-sulphate sludge is fed into the anode compartment; caustic soda being withdrawn continuously from the cathode compartment. The temperature may be between 15° and 90° C. A voltage of from 2·5 to 5 volts can be employed; and the current density may be 1 to 2 amperes per square decimetre.

The diaphragm is composed of portland cement rendered porous by making-up the cement with a solution of common salt, or any other suitable soluble material. The gases evolved at the anode (SO_2 and oxygen) are separately collected from the cathode gas (hydrogen).

The same electrolytic cell may be used when the melt is to be treated as a whole. In this case, the melt may be dissolved with the smallest possible quantity of water, and charged into the anode compartment of the cell, together with a suitable working volume of water. In the

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36, Victoria Street, London, S.W.

course of the electrolysis the sulphuric acid produced at the anode neutralizes caustic soda and decomposes sodium phenate in the dissolved melt, and liberates the phenol, which may be run off from the surface of the liquid in the anode compartment.

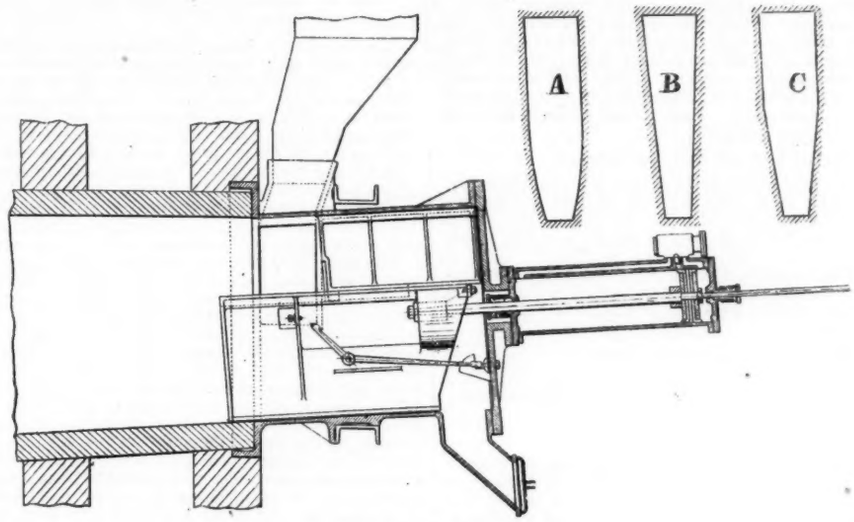
Retorts for the Distillation of Coal.—No. 129,139.

WEST, J., of Southport, and WILD, W., of Blackpool.

No. 11,738; July 17, 1918.

This invention relates to horizontal and inclined retorts of the type described in patent No. 113,981, in which the feed is effected by plungers which force forward the mass of the material in the retort.

The patentees say: With continuously operating retorts difficulties are encountered owing to the resistance which the material offers to the plunger or propeller. Increase of pressure applied to the mass in the retort may not ensure an efficient feeding and discharging action, for the coal appears to wedge itself in the retort. By investigation and experiment, we have found that if the retort be so shaped that the weight of the coal is distributed fairly evenly over the sides and bottom, instead of being carried practically entirely by the bottom of the retort, the plunger is enabled to effect more efficient propulsion of the charge through the retort with a minimum of pressure, for the resistance to propulsion is more uniform over the whole of the mass, and buckling or wedging of the charge is obviated.



West and Wild's Retorts.

Their invention therefore consists in making the retort with its sides tapering towards one another as they approach the base of the retort, which is preferably of the minimum width allowable having regard to practical and manufacturing considerations.

A sectional elevation is given at the charging end of a continuously operating horizontal retort (as in patent No. 123,441), so as to indicate the character of retort to which the invention is applied. Typical retort sections A, B, C, in accordance with the present invention, are shown.

The retort may be of substantially wedge-shape in cross section, with its sides tapering (but preferably curved) to a short base, as in A. Or it may resemble the elevation of a crucible. The sides may taper over their full depth as in B, or for a part only of their depth, the remaining parts being parallel to one another as in C.

With any such arrangement, "not only is the weight of the charge distributed more evenly over the surface of the retort, but, by reason of the reduced thickness of the coal in the base of the retort, the heat penetrates and completely carbonizes the coal very readily, and so gives it greater power to resist buckling during propulsion, and at the same time reduces the friction between the charge and the retort surface."

The shape of the retort is said to be specially advantageous in that its maximum width, being at the top, admits of a wider opening for the coal feed and a freer exit for the gas evolved from the coal. Further, the heating of the retort can be more effectively performed, as the shape of the sides permit of greater heat transference by conduction than with retorts having vertical sides.

Removing Sulphur from Oils.—No. 129,349.

FORWOOD, G. F., of Mark Lane, E.C., and TAPLAY, J. G., of Streatham Hill, S.W.

No. 15,672; Oct. 27, 1918.

This invention consists in removing sulphur from oils by washing them with solutions of the sulphides of the alkalies, or solutions of the sulphides of the alkaline earths, with suitable agitation. The patentees state that they have found that in oils such (for instance) as shale oil, the sulphur exists in the form of a carbon sulphur compound or of a compound containing hydrogen, carbon, and sulphur, while in some oils both forms occur.

In carrying the invention into effect, the oil is mixed with a solution of sulphide of alkali or alkaline earth; the process being carried out in a vessel fitted with a device to keep the oil and the re-agent agitated and well mixed. The mixture is then allowed to stand, and the oil readily separates by reason of its lower specific gravity.

In one example, some shale spirit was agitated at atmospheric temperature with a solution prepared by saturating a strong solution of caustic potash with sulphuretted hydrogen—the resultant liquid being then saturated with flowers of sulphur. The agitation was continued for six hours, after which the spirit and the washing reagent were allowed to rest, to promote their separation. The washing reagent was then drawn off from the bottom of the washing vessel, and the spirit was well washed with water, followed by a washing with a small quantity of a 5 p.ct. solution of caustic soda, in order to remove all traces of sulphides and sulphuretted hydrogen, and again washed with water to remove traces of soda. The traces of water were removed by settlement. The amount of sulphur contained in the shale spirit before washing in the above manner was equal to 3·1 p.ct. by weight; while the sulphur content of the shale spirit, after washing as described, was equal to 0·8 p.ct., showing a reduction of 2·3 p.ct. by weight, or equivalent to a reduction of 74 p.ct. of the original sulphur present.

According to another example, the sulphur compound is removed from the spirit by washing the latter with an alkaline sulphide solution, heated to a temperature of about 40° C. The spirit is then washed with a dilute solution of caustic soda, followed by a washing with water. For instance, caustic benzol containing 0·3 p.ct. of sulphur may be agitated with a solution of potassium sulphide heated to a temperature of about 40° C. After removing the spent washing liquor, the spirit is washed with a dilute solution of caustic soda, followed b a washing with water. The spirit will then be found free from sulphur compounds.

APPLICATIONS FOR PATENTS.

[Extracted from the "Official List" for Aug. 7.]

Nos. 18,617—19,192.

ARMSTRONG, H. L.—"Retorts." No. 18,917.
BROWNING, W. J.—"Process for production of hydrogen sulphide from sulphurous gases." No. 19,027.
BUSSEY, C. C.—"Treating carbonaceous material for recovery of volatile hydrocarbon constituents." No. 18,837.
DAVIDSON, T. M.—See Armstrong. No. 18,917.
HANCOX, E.—"Gasholders, &c." No. 19,179.
KNOTT, G. F. J.—"Gas-stove torch." No. 19,071.
LOW TEMPERATURE CARBONIZATION, LTD.—See Armstrong. No. 18,917.
MACLEOD, J. G.—See Browning. No. 19,027.
PARKINSON AND W. & B. COWAN.—"Prepayment mechanism for gas, &c., meters." No. 19,180.
WELSBACH COMPANY.—"Gas-lighting devices." No. 18,889.
WILSON, J.—See Parkinson. No. 19,180.

Gas and Electricity Extensions at Blackburn.—Two schemes involving a very large outlay were last week sanctioned by the Blackburn Town Council. The tender of the English Electrical Engineering Company, of Preston, was accepted for the erection of a new generating station, the total cost of which reaches £270,000; and a loan was also approved of £133,600 for extensions to the Greenbank works.

Australian Gas Light Company's Progress.—In connection with the notice in the "JOURNAL" a fortnight ago [p. 233] of the retirement of Mr. R. J. Lukey, J.P., from the Secretaryship of the Australian Gas Light Company, Sydney (N.S.W.), it may be mentioned that when he entered the Company's service thirty years ago the number of consumers was 25,381, which has increased to 139,611. The gas sold has increased in the same period from 1,048,313,000 c.ft. per annum to 3,784,919,000 c.ft.; the coal used from 115,000 tons to 400,000 tons (coal and oil combined) per annum. The revenue from all sources in 1889 was £303,986; whereas during the past year it reached £1,062,274. Notwithstanding this large increase and war conditions, bad debts have decreased nearly £800 per annum—*i.e.*, from £2732 to £1936.

PARLIAMENTARY INTELLIGENCE.

HOUSE OF LORDS.

Progress of Bills.

The Bournemouth Gas and Water Bill was read the third time, with the amendments, and passed.

The Gas and Water Provisional Orders Bill was read the third time (according to order), with the amendments, and passed.

The Bedwellty Urban District Council Bill was read the third time, with the amendments, and passed.

HOUSE OF COMMONS.

Progress of Bills.

The Huddersfield Corporation Gas Bill and the Stockton-on-Tees Corporation Bill were read the third time, and passed, with amendments.

Summer Time.

Captain TERRELL asked the Prime Minister whether, in view of the varying criticisms regarding the adoption of summer time, he proposed to appoint a Committee to investigate its operation, so as to arrive at what should be a definite permanent policy on the whole subject.

Mr. SHORTT (the Secretary of State for the Home Department), who replied, said very few criticisms had reached the Home Office for a long time past, and it was believed the general feeling was strongly in favour of the continuance of the system. If any further representations on the subject were submitted, they would of course be carefully considered by the Government. As at present advised, however, he saw no occasion for a further inquiry.

Justice Sankey and the Coal Commission.

Sir RICHARD COOPER asked the Prime Minister if Mr. Justice Sankey, before his elevation to the Bench, had held the position of Standing Counsel to the Miners' Federation; and was this fact brought to his notice when he asked Mr. Justice Sankey to preside over the recent Coal Commission?

Mr. BONAR LAW: I am unaware whether or not the suggestion contained in the question represents the facts; but I am quite certain that the innuendo which it contains against the impartiality of a Judge of the Realm ought not to be made.

Scientific and Industrial Research.

Among the Civil Services Estimates for 1919 20, under Class IV., appear the items: Scientific investigation, &c., £63,974; and scientific and industrial research, £162,815.

Coal Mines Deficiency.

The following is also included in the Civil Services Estimates: "That a sum not exceeding £26,400,000 be granted to His Majesty, to defray the charge which will come in course of payment during the year ending March 31, 1920, to meet the deficiency arising under the Coal Mines Control Agreement (Confirmation) Act, 1918, and the cost of carrying out the recommendations contained in the interim report of the Chairman of the Coal Industry Commission, dated March 20, 1919, and for kindred purposes."

LEGAL INTELLIGENCE.

An Expensive Theft of Gas.

Before Mr. Chester Jones, at the Lambeth Police Court, Frederick Cope, of Camberwell, pleaded "guilty" to stealing a quantity of gas, valued at 1d., the property of the South Metropolitan Gas Company. Mr. H. E. Morgan, an Inspector in the service of the Company, stated that he went to the house occupied by Cope, and found that the meter had been removed and the service-pipe connected directly with the pipe supplying the house. The gas-stove was alight. Detective-sergeant Kenward said that Cope was an inspector in the service of the Metropolitan Water Board. It was believed that the offence had been going on for some time. Mr. Chester Jones: We will see that you do not make a profit out of it, Mr. Cope. You will have to pay a fine of £20.

Irish Gas Undertakings in Court.

In the Chancery Division of the High Court of Ireland, Dublin, before Mr. Justice Powell, in the matter of the Gorey Gas and Water Company (now wound up), Mr. Dickie, K.C., applied, by way of final allocation, for an order sanctioning the payment of a dividend of 10s. 4d. in the pound to the unsecured creditors, and directing that the Receiver and Liquidator should be discharged, and the Company dissolved. His Lordship made the order sought. In the same Court, in the matter of the Ennis Gas Company, Limited, Mr. E. J. Phelps applied for an order directing that the Company be wound up; the application being based on the petition and affidavit of Dr. Arthur Green, of Ennis, one of the Directors. It was explained that the Company was formed for the purpose of providing the town of Ennis and the neighbouring district with gas, and that for a number of years a flourishing business had been carried on. But since 1917 there has been a considerable loss; and it is now proposed to sell the undertaking as a going concern to a number of townspeople of Ennis, who are anxious to carry on the work of the Company. Good title to the concern could not be made without an order of the Court dissolving the Company. Mr. Costello, on behalf of the Company, consented. Mr. Justice Powell made the order sought.

MISCELLANEOUS NEWS.

GLASGOW CORPORATION GAS UNDERTAKING.

Jubilee Balance-Sheet.

The fiftieth annual balance-sheet of the Glasgow Corporation Gas Undertaking for the year ended May 31 last shows that the gross revenue amounted to £1,940,036 and the gross expenditure to £1,786,174, to which is added depreciation written-off capital assets, £23,867, giving a total of £1,810,041. The balance carried to profit and loss account was £129,995.

The Committee had to meet the following requirements last year:

Annuities on stocks	£19,060	5	0	
Contribution to Glasgow Corporation loans fund in respect of Glasgow Corporation 3 p.ct. stock, redeemable 1921, issued in lieu of converted gas annuities . . .	9,885	0	10	
Interest on borrowed money, &c. . . .	45,442	7	11	
Sinking fund.	73,298	0	3	
				£147,685 14 0
leaving a deficit on the year's operations of	£17,690	8	11	

This has been partly met out of surplus revenue account, £7583 3s. 9d.; and the balance out of reserve fund account, £10,107 5s. 2d.

The quantity of coal carbonized during last year was 832,424 tons, as compared with 892,026 tons for the preceding year, or a decrease of 59,602 tons. The average cost of coal carbonized was 23s. 7·492d., being an increase of 4s. 7·852d. The market for residuals has been more favourable to the Corporation during the past year. The average price received per ton of coal carbonized was 5s. 1·737d., as compared with 4s. 7·162d. for the previous year, an increase of 6 575d. per ton. The net sum realized from the sale of coke amounts to £333,249, being £90,807 more than that of the preceding year. The total quantity of coke sold was 391,705 tons, compared with 372,686 tons for the previous year, an increase of 19,019 tons. The average price received was 19s. 1·454d. per ton, as compared with 14s. 3·353d.

The quantity of coal gas made was 9967 c.ft. per ton of coal carbonized, as compared with 10,073 c.ft. per ton for the previous year. The quantity of water gas made was 252,671,000 c.ft., equal to an additional 304 c.ft. per ton of coal carbonized. The quantity of gas delivered and accounted for during the year was 7,911,820,004 c.ft., as compared with 8,189,904,386 c.ft. for the preceding year—a decrease of 278,084,382 c.ft., equal to 3·395 p.ct. The unaccounted-for gas was 7·467 p.ct., as against 8·857 p.ct.—a decrease of 1·390 p.ct.

The Government oil-washing plant at Provan has been shut-down since the armistice; and negotiations are taking place regarding the disposal of the plant. For this works, tenders have been requested from contractors for the erection of a vertical retort installation. As soon as this contract has been placed, arrangements will be made to proceed with the additional plant required to complete the new section of the works. The water gas plant now being erected by Messrs. Humphreys and Glasgow is well advanced, and will be ready for the winter season. The Government oil-washing plant at Dawsholm has also been shut-down since the armistice. This plant can be utilized with advantage to the Corporation; and arrangements are being made to acquire it from the Government. The water-gas plant erected at Temple works has been in use since October last. The oil-washing plant installed at Tradeston has continued to work well; 237,834 gallons of crude benzol having been produced during the year. The foundations for Nos. 5 and 6 benches of vertical retorts at the Dalmarnock works have been completed, and the building of the fire-brick work of the benches commenced. Tenders for the erection of the steel work of the coal and coke hoppers and the superstructure over the benches, have been obtained, and the contracts placed.

A table of the Corporation gas appliances in use shows the number to have increased from 21,053 cookers in 1901 to 219,647 now.

MUNICIPAL TRADING UNFAIRNESS AT PAISLEY.

Electricity Deficiency Must be Made Up by Gas.

An extraordinary condition of affairs—and one altogether unfair to the gas consumers—was revealed during the explanation of the Municipal Budget to the Paisley Town Council. The financial statement was presented by Treasurer MacKean, whose remarks on the subject of the gas and electricity accounts will be best appreciated if reproduced in his own words. He said: I will consider the gas and electricity accounts together, as any deficiency on the electricity account must be made up by the gas. The gas accounts for last year did extremely well, insomuch as there was a profit of £3535. This speaks extremely well for the prescience of the Gas Manager (Mr. A. S. Nisbet) and the Convener (Councillor Henderson). But the estimates for this year at present rates show a very different state of affairs. At the end of this year, there will be a deficiency on the year's working of no less than £14,436. Subtracting the £3535 profit last year, leaves the sum of £10,900, which must be raised by an increase in the rate for gas.

But that is the least of it. Turn now to the electricity account. What of it? Last year's working shows a loss of £13,478. It is true that £3300 of this is owing to over-statement of stocks by the late Manager (Mr. Parkinson), and a large account of £700 which has proved to be irrecoverable. These sums ought to have gone into the previous balance-sheet; but not having been accounted for there, they must be paid now. And the estimate of the loss which will result from this year's working is not much better; for it is calculated to amount to £11,341. The deficiency last year and the estimated de-

ficiency this year amount therefore to £24,819. How is this to be met? I cannot put too much on to the price charged for electricity, as that would kill our trade; but I must do my best.

After consulting Mr. Smith (the Manager) and the Convener, the following increases are suggested: Rates for lighting to be increased 2½d. per unit, which it is hoped will produce £5700. Power (old schedule) to be increased from 35 p.ct. to 70 p.ct., which will bring in £250. Increase on new schedule of 25 p.ct., which ought to yield £900. Increase on coal clauses, owing to increase in cost of coal, £750. Public lighting, an increase of £6 per large lamp and £1 per small lamp, should give £617. Then we have the revenue from traction to the Tramway Company, the contract for which will expire in August. It is proposed to ask an increase of price of at least 25 p.ct.; but this must go to arbitration. We will only benefit by whatever increase is granted for eight months this year; and if our anticipations turn out correct, this source should bring us an increase of £1350. These various items total in all £9567, which is just about one-third of the deficit.

The remainder falls to be met by an increase in the price of gas, as that is the law. The gas has therefore to meet:

Estimated deficiency in this year's working.	£10,900
Estimated deficiency on electricity	15,252
Total	£26,152

To meet this, an increase of 1s. 3d. per 1000 c.ft. is required, which will bring the price up to 5s. 5d. per 1000 c.ft.

This is a melancholy statement; and I hope it will make the ratepayers think. The electricity department is a beautiful example of the vast benefits which are to be derived from municipalizing industries. It has been recklessly and extravagantly managed from its inception. Had the undertaking been in the hands of a private company, and managed in a similar manner, it would have been bankrupt years ago, and its assets sold for what they were worth. A new company would have succeeded the old, and carried on, on a sound basis, and not hampered by the debts of the old company. There is no such relief to be got for a municipal concern, which must pay up capital and sinking fund for every penny it borrows, however foolishly. This concern has been carried on for many years, and has never really paid its way. Our works stand at £165,000, and involve a loan charge of about £11,500. Then £85,000 more is about to be borrowed, which will involve a further annual charge of £8500, making it in all £20,000 per annum. What concern could stand such a debt as this? We have got now a most able Manager and a most indefatigable Convener; but I do not envy them their job, as it must be heart-breaking work.

The community would be infinitely better if they were quit of the whole undertaking; but they can't get quit of it until it pays up its debt, which seems to mount higher and higher the longer the concern is carried on. If it were possible to get it merged in some larger undertaking, perhaps that would be the best way out of the difficulty. If our present Manager cannot make it succeed, with the improved machinery which he is installing, I am doubtful if anyone can. If it is to go on at the present rate of loss, the whole concern would be better scrapped, and the community better by cutting their loss. But the history of this concern will prove a good lesson, if it makes the ratepayers think, not once, but twice or thrice, before they permit the Town Council to enter into any other municipalizing scheme.

And what do the gas consumers think about it all? They have to pay an extra 9d. per 1000 c.ft. on the gas they use for the glory of owning an electricity undertaking which is losing at the rate of £11,000 a year. It is a hard case for the gas users; but the Legislature had to give some guarantee to the lenders of money to electric undertakings for repayment of their capital, or else these undertakings would never have got it at all. So far as Paisley is concerned, it is a pity that it ever did get the money.

GAS COMMITTEES AND THE COAL COMMISSION.

Mr. Gorman, at a meeting of the Salford Town Council last Wednesday, moved that a resolution of the Gas Committee be not approved; the speaker describing it as a "piece of impertinence." The resolution said that the Committee viewed with the greatest alarm the reports of the Coal Commission, which it considered did not represent an impartial examination of the subject, and strongly protested against the adoption of the recommendations of the reports as to the nationalization of the mines, which would undoubtedly have the effect of most seriously interfering with the trade of the country and disorganizing the whole of its industries. Alderman Phillips (the Chairman of the Gas Committee) said it was a local matter, as was shown by one of the first effects of the Commission—the raising of the price of coal by 6s. per ton. This would increase the expenditure of the Gas Committee by something like £40,000 per annum, and so would affect every ratepayer in the borough. He contended that the inquiry was not impartial, because both sides had made up their minds beforehand. Someone ought to have been appointed who was not interested on one side or the other. The Gas Committee would have to ask for a further increase in the price of gas. Alderman Desquesnes said the whole question was one for the Government. The minutes of the Committee were adopted, with the exception of the resolution referred to.

A similar resolution had been passed by the Halifax Gas Committee; and at the last meeting of the Town Council, Mr. Bellamy moved that the resolution be deleted. Alderman Morley said it was amusing to see the Gas Committee setting their opinions against the views of the experts who had recommended nationalization of the minerals; and Alderman Taylor declared the Gas Committee ought not to dabble in political questions. The Mayor said that if it could be shown that nationalization would benefit the country as a whole, the majority of the people would be in favour of it. They must be quite sure that it would be for the benefit of the country as a whole; but recent events seemed to throw some doubt on this point. Mr. J. H. Waddington (the Chairman of the Gas Committee) said users of coal had not been taken into account by the Coal Commission. The Gas Committee had passed the resolution because they were alarmed at the tendency towards further control. The Committee were not free agents; they could not buy coal in the open market. They had to make use of the coal which was sent to them; and they were told what prices they had to pay. He believed that under a scheme of nationalization things would be even worse. Before anything definite was done in this direction, the well-considered judgment of gas committees, electricity committees, manufacturers, and householders ought to be taken into account. The amendment was defeated, and the minutes of the Committee adopted by a large majority.

The Macclesfield Town Council have also had before them for consideration a recommendation of the Gas Committee to support the National Gas Council resolution regarding the nationalization of mines. In the course of a report dealing with the present difficulties of coal control, which came before the last monthly meeting, the Gas Engineer (Mr. F. W. J. Belton) stated that Macclesfield, which was situated right on the North Staffordshire coalfield, had not been allowed to increase its supplies from there, but had been compelled to take unsuitable coal from a greater distance. Last winter the Coal Controller actually took part of the gas-works supply of South Yorkshire coal to send to other works; and, as a consequence, there was a shortage of coal at the gas-works, and they had at one period to make carburetted water gas, with the result that there was a coke famine in the coldest weather. This summer he had urged the Coal Controller to allocate more North Staffordshire and Derbyshire coal to the gas-works, as these were their nearest and most suitable fuels. The reply was that this could not be done; but they could have Durham coal. "If," says the report, "there was anyone at the Coal Control who knew anything about gas-works, he would know that Durham coal was not suited to our plant. I pointed out to them that Durham coal, while not suitable for us, was more suitable for gas-works equipped with horizontal retorts than the coal I wished to get. I was informed, in reply, that if I did not take Durham coal, they could not do anything else for me. Durham coal would cost us at least 35s. per ton, instead of about 26s. to 27s., which is what we are now paying. Experience of this kind has been repeated and multiplied in gas-works all over the country; and if nationalization of mines means a continuance of this kind of thing, with an absence of competition, and allocation of supplies by men who know nothing about the suitability of different classes of coal for different types of gas-making plant, then it will not be a good or helpful thing for the gas industry." Alderman Isherwood moved the confirmation of the minutes. This was seconded, and after some discussion was agreed to.

A minute of the Stockport Gas Committee supporting the National Gas Council's views was, after some discussion, referred back.

STOCKPORT GAS UNDERTAKING.

In moving the adoption of the Gas Engineer's report at a meeting of the Stockport Town Council last Wednesday, Alderman Welsh pointed out that the wages paid in the gas department for the year ended March 31, 1914, were £28,237; and for the year to March, 1919, the amount was £80,000. There had been a great outcry about the price of gas being too high; but it was just as well that the public should know how the increase came about. The amount paid in wages alone showed an increase of 180 p.ct. Then for coal and oil they paid in 1914, after deducting residuals, £23,716; and for the year 1918-19, £52,575—or an increase of 122 p.ct. All materials and maintenance had gone up at least 100 p.ct. The effect was that, after deducting the sales of residuals, the working cost had gone up from £71,178 in 1914 to £148,131. Then the effect of the Daylight Saving Act and the Household Fuel and Lighting Order had been greatly to reduce the consumption of gas. Nearly all the authorities in the neighbourhood were now round about or approaching 5s. per 1000 c.ft. in their charges for gas. The recent increase of 6s. per ton on coal would cost the department at least £20,000; and the coke consumers would have to bear a portion of this. The benefit of the increase in the price of gas to 5s. was only felt in the last quarter. They would have it in the coming year; and they were hoping that, by exercising every economy in the working of the department, they would be able to go on without any further increase. The motion was seconded by Mr. Lomas and agreed to.

BOLTON GAS-WORKS ACCOUNTS.

The report of the Gas Committee to the Bolton Town Council (signed by the Chairman, Mr. W. Heaps) says that the balance of revenue account for the year ended March 31 shows a gross profit of £90,820; being an increase of £23,325 over the previous year. Of this £15,000 has been placed to depreciation and renewals fund, an increase of £5000 over the previous year, and £4039 to revenue contributions to capital, leaving a balance of £5239 to be carried forward to next year, or an increase of £1542.

During the past year, advantage has been taken of the fact that the installation of vertical retorts at the Lum Street works has reduced the costs of gas manufacture; and the bulk of the gas has been produced there, with the result that the output from the Gas Street works was reduced from 514,215,000 to 210,042,000 c.ft., or 21 per cent. of the total make, against 52 p.ct. last year. Owing to war conditions and the necessity of retaining the whole of the employees, coupled with the fact that there are a considerable number of old men engaged, and the standing charges which have increased due to the lessened production, the manufacturing costs at the Gas Street works have been practically doubled. An increased efficiency in carbonizing results has been obtained. War conditions affected the manufacture of gas at the works, with a possibility of considerable inconvenience

from naphthalene stoppages. Alterations, however, were made to the benzol plant which have not only averted the difficulty, but considerably reduced the number of naphthalene stoppages met with. The alterations to the plant have proved a financial success, and are of considerable technical importance. Coal deliveries have been such that has been necessary to work largely out of stock, causing considerable increase in coal handling charges. The Committee have under consideration the renewal of the carbonizing plant, now past its useful life, and other minor renewals.

The Lum Street station has produced 79 p.ct. of the total gas made, or 301 million c.ft. more than last year, with only a slight increase in the wages paid. During the year, the cost of coal increased 4s. 2½d. per ton, and considerable increase had to be met for labour charges. Despite these factors, owing to the higher efficiency in the working at this station the manufacturing costs have been reduced.

Despite war conditions, both works have been well maintained; but they are now faced with the necessity of carrying out several renewals and extensions.

Owing to the reduced coal supplies and the threatened strikes, coupled with the excessively increased demands for coke, the difficulties to cope with have been numerous, but have been successfully met. The coal received, in general with other gas undertakings, continues of the same poor quality.

The following comparative statistics are given of the working under the Engineer and Manager (Mr. W. J. Smith, B.Sc.):

	1919.		1918.
Tons of coal and cannel carbonized . .	73,784	..	88,157
Average cost per ton	24s. 5d.	..	20s. 2½d.
Percentage of cannel used	3·04	..	0·47
Gas made in c.ft.	989,127,000	..	988,424,000
Do. do. per ton carbonized. . . .	13,405	..	11,212
Gas accounted for in c.ft. per ton carbonized	12,818	..	10,810
Gas unaccounted for p.ct. through leakage and condensation	4·38	..	3·58
Maximum quantity of gas supplied in 24 hours during the year, c.ft. . . .	4,669,000	..	5,240,000
Minimum quantity do. do. . . .	977,000	..	1,060,000

FIRE AT THE REDHEUGH GAS-WORKS.

The Redheugh works of the Newcastle-on-Tyne and Gateshead Gas Company were last Friday the scene of a fire which broke out in an engine-house, 70 ft. by 45 ft.

When the fire brigades arrived, the roof had fallen in, and the building, which is situated between two large holders, was burning furiously. At one time it appeared that the holders might become involved; but with the aid of a copious supply of water the firemen succeeded in preventing the flames from spreading. As a result of the intense heat, a distribution main in the house cracked, and the gas became ignited; but the flooding of the building overcame this, and the fire was extinguished after three hours' hard work. The distribution of gas will not be affected by the fire.

INCREASES IN PRICE OF GAS.

The Aldershot and District Gas Company announce an increase in the price of gas, as from the 1st inst., of 1s. per 1000 c.ft. It is pointed out that under the new conditions laid down by the Coal Controller, the Company's supply of coal is costing 18s. per ton more. The Directors of the Annfield Plain and District Gas Company announce that the price of gas to ordinary consumers will be advanced 7½d. per 1000 c.ft. after meter readings for the Midsummer quarter. At Carnarvon the price has been advanced to 5s. 3d. per 1000 c.ft., as from July 1. The Cavan Gas Company have advanced their price 10d. per 1000 c.ft. The Crieff Gas Light Company are paying a dividend of 7½ p.ct. The price of gas is raised from 5s. to 5s. 5d. per 1000 c.ft. At Dewsbury, gas is advanced, as from the June meter readings, by 4d. per 1000 c.ft. The Doncaster Town Council have decided, subject to securing powers to raise the maximum price for gas, to advance the charge from 3s. 9d. to 4s. per 1000 c.ft. for power, and from 4s. to 4s. 6d. for lighting. It was stated that the 6s. on coal will cost £7760 per year extra, equivalent to 7½ per 1000 c.ft. in the cost of gas. The Gas Committee of the Dukinfield Town Council have increased the price of gas 6d. per 1000 c.ft., making the rate 5s. At Falkirk the increase is 10d., making the rates: Prepayment meters, 5s. 11d. per 1000 c.ft.; lighting and domestic purposes, 5s. 9d.; and power and manufacturing, 5s. 3d.. The Filey District Council have increased the price of gas from 5s. 2d. to 5s. 10d. per 1000 c.ft., to take effect as from the end of September. The Ilkley Urban District Council are increasing the price of gas from 4s. 3d. to 5s. per 1000 c.ft. The Kelso Gas Company have increased the price of gas for power purposes from 4s. 7d. to 5s. per 1000 c.ft.; through ordinary meters, from 5s. 5d. to 5s. 10d.; and through prepayment meters, from 5s. to 5s.10d. At Kirkcudbright, the increase is 1s. 1½d., making the rate 8s. 2½d. per 1000 c.ft. The Kingston-on-Thames Gas Company announce an increase in the price of gas of 1s. per 1000 c.ft., making the charge 5s. The Knutsford Light and Water Company are increasing the price of gas 6d. per 1000 c.ft., making the charge now 5s. 2d. Slot-meter users hitherto have had meters supplied free, but now they are to be charged 1s. per quarter. The price of gas in Londonderry has been advanced 6d. per 1000 c.ft. The Directors of the Matlock and District Gas Company give notice of an increase in the price of gas of 5d. per 1000 c.ft. to all consumers. The Perth gas rate is increased 5d., making the price now 4s. 10d. per 1000 c.ft. The price of gas at Ramsgate is to be raised from 5s. to 7s. per 1000 c.ft. The St. Helens Town Council last Wednesday decided to increase the price of gas 6d. per 1000 c.ft. as from the August readings. Application is to be made for power to increase the maximum charge to 6s. per 1000 c ft. within, and 6s. 6d. without the borough. The Silsden District Council have advanced the charge for gas from 3s. 9d. to 4s. 7d. per 1000 c.ft. In a notice to the consumers, the Directors of the Staveley Gas Company state that they are compelled to increase the price of gas to ordinary consumers 8d. per 1000 c.ft.; and the quantity supplied through prepayment meters will be reduced 1 c.ft. per 1d. The Tottenham District Light, Heat, and Power Company have given notice of an increase of 8d. per 1000 c.ft. in the price of gas. The reasons given are the 6s. increase in the price of coal and the extra cost of sea-borne freights. The Wolstanton District Council have agreed to a recommendation of the Gas Committee that the price of gas be increased 6d. per 1000 c.ft.

PEAT GAS AS A POWER SOURCE.

Experiment in an Irish Factory.

Mr. H. Robb, of the textile firm of Messrs. Hamilton, Robb, Ltd., of Portadown, co. Armagh, in a letter to the Press on the result of eight years' use of peat gas as a source of power, states that the Company's engines have during this period worked as satisfactorily as, and more economically than, they did when power was generated from anthracite coal—and this on the basis of coals at pre-war prices. To check and supplement the firm's observations, Mr. F. W. Parkinson, M.I.E.E., of Belfast, was instructed to test the plant; and Mr. Robb quotes his report in the following terms:

The weaving factory is driven by three Stockport gas-engines, one rated at 150 B.H.P. and two at 120 B.H.P. These are single cylinder engines driving on to the main shafting through ropes. The gas plant comprises gas-generators, wet and dry scrubbers, tar-extractor, fan and gasholder, and is supplied with peat as it comes from the bog by means of a transporter, which delivers direct from the barge into the hopper of the generators. The test was taken under ordinary factory conditions, and no preparation was made in the way of special cleaning of plant or engines or of valve grinding. Arrangements were made for weighing the peat, and indicators were fitted to each engine; cards being taken every half hour for a full working day of ten hours. The average indicated horse power during this time was 277·4, and the amount of peat consumed 7712 lbs., which is equivalent to 2·78 lbs. of peat per I.H.P. hour or, assuming 88 p.ct. mechanical efficiency, 3·16 lbs. of peat per B.H.P.-hour. Allowing 3 cwt. for banking, the all-round consumption may be taken as 3·5 lbs. per B.H.P.-hour—this would be an outside figure. The peat used in the trial had an average of about 25 p.ct. moisture. By handling large quantities and the utilization of every practical labour-saving device, peat can be won from the bog, dried, and delivered from a radius of five miles into a generating station at a price which would not exceed 0·28d. per unit of electricity generated. This compares very favourably with a modern steam turbine plant operating at 160 to 180 lbs. pressure, 100° Fahr. superheat, and 28 in. vacuum, which, under similar conditions of loading, would cost 0·42d. per unit, taking coal at a price of 35s. per ton, also with an anthracite gas plant at a cost of 0·36d. per unit, with anthracite at 45s. per ton. The actual cost of coal, of course, would vary with the locality and facilities for transport. It is reasonable also to suppose that peat-gas plants will be worked in conjunction with bye-product recovery plants, which will not only reduce the cost of the power generated, but will provide a supply of fertilizer for raising food on the land won from the bogs after stripping away the peat.

GAS AND ELECTRICITY PRICES IN GLASGOW TO REMAIN UNALTERED.

On Thursday the Glasgow Corporation will have before them recommendations of the Gas and Electricity Committees to the effect that present prices for gas and electric current remain unchanged.

Councillor Drummond (Convener), at the meeting of the Gas Committee on the 1st inst., dealt with a motion that was submitted, that the price of gas be increased by 2d. per 1000 c.ft. An amendment, that there be no increase, was however carried by 9 votes to 8. On April 17 of the present year the price was raised from 3s. 9d. per 1000 c.ft,, at which it had stood since July 31, 1918, to 4s.

The Electricity Committee submitted the annual accounts, which showed that the revenue for the year to May 31 was £865,039, and the working charges £567,259, leaving a balance of £297,780, from which there has been deducted: Depreciation £60,464, interest on loans £106,481, and sinking fund £98,073—a total of £265,019. The surplus of £32,761 has been transferred to the reserve fund, which now amounts to £64,008. The revenue shows an increase over last year of £76,037, and the working expenses an increase of £24,542. The net profit is an increase of £25,616 over last year. The Committee agreed to recommend that no change be made meantime in the ordinary rates charged for energy for lighting and power supplies.

COALITE AMALGAMATION SCHEME CONFIRMED.

At Extraordinary Meetings of the British Coalite Company, Ltd., and of Coalite, Ltd., last week, the resolutions for amalgamation with Low-Temperature Carbonization, Ltd. [see *ante*, p. 246], were unanimously confirmed.

Mr. H. Willmott, who presided, said the satisfactory position was thus arrived at by which the undisputed pioneers of low-temperature carbonization were now firmly bound together into one large powerful Company. Something like a million pounds sterling had been expended by the Companies in research. Practically every kind of coal had been tested; and the new Company were now possessed of experience lacking in the case of any of their competitors. Never had the time been so opportune for the development of their process. The

fact that numerous imitators and references to so-called low-temperature schemes had recently appeared in the Press need give no cause for alarm, as their Company were secure in their long experience, excellent results, and strong financial position. Preparation for the construction of new large-scale plants was already under way; and contracts were being negotiated which would embrace some further large installations. By properly designed and skilfully constructed low-temperature installations, real economy in the use of coal could be made, and thus avert the industrial destruction of this country which was threatened by the rise in coal prices. The Directors were assured that they could confidently leave future developments in the hands of the Low-Temperature Company's technical staff, with every prospect of good results.

POWER ALCOHOL.

Synthetic Production of Benzol.

[From "The Times" of July 24.]

The report of the Inter-Departmental Committee on the Production and Utilization of Power Alcohol, which appeared at the beginning of this month [*ante*, p. 82] recommended the establishment of a Government organization to initiate and supervise experimental and practical development work on the subject; and it is understood that such an organization, with funds, is to be set up under the Department for Scientific and Industrial Research.

The same report referred to the possibility of obtaining large supplies of alcohol synthetically from the products of coal distillation; but the matter appears to have advanced farther than might be supposed from the somewhat guarded terms of the reference. The gases produced from gas-retorts and coke-ovens contain about ½ p.ct. by weight of ethylene; and a process is being worked out for collecting this ethylene and converting it into alcohol. For extracting it, use is made of the property possessed by cooled charcoal of absorbing gas; and the charcoal, when charged with the gas, is carried in a stream of molten lead, the heat of which causes it to give up the ethylene, which is then treated catalytically for the production of alcohol.

The amount of ethylene in the gas-works and coke-oven gases of this country is estimated to be sufficient to yield annually up to 150 million gallons of 90 p.ct. alcohol, which the manufacturer could afford to sell at a price of, perhaps, 1s. 3d. a gallon; and even if it were found impracticable, owing to such difficulties as that of collecting the ethylene from all the gas-works, many of which are small and are situated in remote districts, to treat only half the total produced, 60 or 70 million gallons would be obtained. Already several important collieries are believed to have in hand the addition of conversion plant to their existing coke-oven installations. The present production of 90 p.ct. benzol in this country is at the rate of about 31 million gallons annually, and may in the near future be increased to 50 million gallons or more. Hence, if the hopes of synthetic alcohol are realized, we may look forward to obtaining from home sources, in the shape of alcohol-benzol mixture, something like one-half of our present requirements of petrol.

CURRENT SALES OF GAS PRODUCTS.

The London Market for Tar, Tar Products, and Sulphate.

London, *Aug.* 11.

There is a considerable amount of inquiry for pitch, and this article shows a firmer tendency; the indication being that higher prices will be obtainable. Creosote is steady at from 5¾d. to 6d. per gallon in bulk.

Solvent naphtha is quiet; the price being called about 2s. 3d. per gallon in buyers' packages. In other directions there is nothing new to report.

Sulphate of ammonia remains unchanged.

Tar Products in the Provinces.

Aug. 11.

The average values for gas-works products during the week were: Gas-works coal tar, 36s. 3d. to 41s. 3d. Pitch, East Coast, 63s. 6d. to 64s. 6d. per ton f.a.s.; West Coast—Manchester, 54s. to 56s. 6d.; Liverpool, 54s. to 56s. 6d., Clyde, 65s. to 70s. nominal. Benzol 90 p.ct., North, 1s. 8d. to 1s. 10d.; crude 65 p.c., at 120° C. 11½d. to 1s. 0½d. naked at makers' works; 50-90 p.ct. naked, North, 1s. 8d. to 1s. 10d. Toluol, naked, North, 2s. to 2s. 1d. nominal. Coal tar crude naphtha in bulk, North, 8d. to 8½d. Solvent naphtha, naked, North, 1s. 8d. to 1s. 11d. Heavy naphtha, North, 2s. 1d. to 2s. 3d. Creosote, in bulk, North, liquid, 5d. to 5¼d.; salty, 4½d. to 4¾d. Heavy oils, in bulk, North, 6d. to 6½d. Carbolic acid, 60 p.ct. 1s. 5½d. to 1s. 6d. Naphthalene, £15 to £17 10s.; salts, £4 10s. to £6, bags included. Anthracene, "A" quality, 7½d. to 7¾d. per minimum 40 p.ct.

FROM A MARKET CORRESPONDENT.

Tar Products.

Conditions are very awkward; and the general opinion is that, when things do settle-down, higher prices will be the order of the day in most products. Meantime there are very few tar distillers at work in the Yorkshire district. Labour in almost all branches is restive; and the Government seem afraid to handle the situation, with the result

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that makers of products are generally more inclined than ever to mark time, and wait to see what is going to happen. Pitch prices are nominally the same as a week ago; but higher prices are being mentioned for export later in the year. At the moment, there is little on offer. Crude tar continues in request; while the fuel position imparts firmness to creosote, the demand for which is expanding, with better terms for new contracts. Solvent naphtha is decidedly firmer, although buyers are not particularly keen in paying the prices now asked. Cresylic acid has not changed; but there is continued improvement in carbolic acid, and up to 1s. 7d. has been offered by buyers of crude. Makers, however, do not care to take out the acid at this price. Crystals are dearer; and there are rumours of competition from a synthetic product if prices advance much more. Some quarters report the price at 9d. per lb.; but I can find no evidence of business at this figure. Naphthalenes are quiet, although there is a slight tendency to improvement in crude. The fire-lighter trade demand is this year rather later than usual. Benzol is somewhat difficult to handle in quantity; and if the trade is to meet the competition of petrol successfully, some improved plan of campaign and more active propaganda are necessary. The Automobile Association have undertaken to prove that good quality benzol is a most satisfactory motor fuel; and arrangements are being made for a road test of 10,000 miles on a moderate-sized touring car.

The range of quotations is as follows:

Benzol: 90% London 2s. to 2s. 2d., North, 1s. 11d. to 2s.; 50-90% 1s. 9d. to 2s. London, 1s. 9½d. North; crude 60-65% 1s. 3½d. to 1s. 5½d.; pure, 3s. per gallon naked.

Carbolic acid: Crude 60's 1s. 6d. per gallon nominal; crystals, 40%, 6d. per lb. asked.

Crude Tar: London, 45s. to 50s.; Midlands, 44s. to 46s.; North, 44s. 6d. per ton *ex* works.

Pitch: London, 67s. 6d. to 70s. per ton; East Coast, 55s. to 60s. per ton; West Coast, 54s. to 58s., with Manchester 57s. per ton and Glasgow 58s. per ton; South Wales, 64s. to 68s. per ton.

Solvent Naphtha: London, 2s. Provinces average 1s. 10d. per gallon.

Crude Naphtha: Naked, 10d. per gallon.

Heavy Naphtha: 2s. 3d. per gallon.

Naphthalene: Refined, £15 to £17 per ton nominal; crude, £4 to £8, according to quality.

Toluol: Naked, 2s. 9d. per gallon nominal. North, 2s. 7d.

Creosote: London, 7¼d.; North, 5¾d. to 6¼d.; heavy oil, 6d. per gallon in bulk.

Anthracene: 40-45%, 6d. to 8d. per unit per cwt.

Grease Oils: 18° Tw. (naked), £6 10s. per ton f.o.r. makers' works.

Aniline Oil: 1s. 2d. per lb.

Cresylic Acid: 95%, 2s. 4d. to 2s. 6d; 97-99%, 2s. 7d. to 2s. 9d. *ex* works London, f.o.b. other ports.

Sulphate of Ammonia.

During 1918, the output of sulphate of ammonia reached 432,550 tons, which was a decline of some 26,000 tons compared with 1917. The make at gas-works showed a decline of 15,000 tons only, which was a very creditable performance—reflecting the efforts of the gas industry to meet a difficult and trying situation. Some of the causes to which the falling-off in gas-works output may be attributed were inferior coal, water gas, increased production of gas by steaming, and loss due to the extended manufacture of concentrated ammoniacal liquor. Coke-ovens produced 164,448 tons; and, taking all factors into account, the total output for the year was in every way satisfactory, although the continual low yield from plants operating the direct-recovery process, compared with the success of some direct installations, seems to call for investigation. A very pleasing phase, however (in view of the export position), is the tendency to manufacture a higher quality of salt. There is really nothing to add to the reports of the last two or three weeks. The demand is very heavy at the fixed price of £19 10s. to the consumer—10s. less per ton to the merchant; and these rates are asked up to the end of September. Winter prices are due for fixing this month; and although control is expected to continue, the consumer will quite likely be asked to pay another pound a ton, although even this advance would hardly make the production of sulphate profitable under present difficult conditions. Of course, there is the foreign trade to help things out; but if the coal situation does not quickly improve, it is doubtful whether there will be much sulphate to spare for export. Then, again, the price will largely depend on the extent of foreign competition—particularly American—in our pre-war markets. For the present, America is having labour troubles of her own, which, if things began to mend here, would give us a little breathing space.

A correspondent recently complained that I had reported the American price at well under £20 per ton, and suggested that rumours of Dutch "sales" had misled me. This is very far from the facts, which are that an American firm sold sulphate of ammonia for export to Spain at £19 5s. per ton. My informant is connected with the firm concerned. The Dutch rumours so impressed me that I did not consider them worth referring to. It does not yet seem to be realized by our manufacturers just how America is taking away our pre-war markets; and a reference to the market reports on sulphate in some of the leading American trade papers would, I think, be somewhat of an eye-opener. My space is gone for this week, but in an early issue I will endeavour to find room for extracts from some of these reports, which will prove conclusively what America is doing and also that prices there have of late been "well below £20 per ton." This figure was the maximum there up to ten days ago.

A fire which originated in the roof of the Royal St. George Yacht Club, Kingstown, causing damage estimated at £3000, was traced to a gas leakage.

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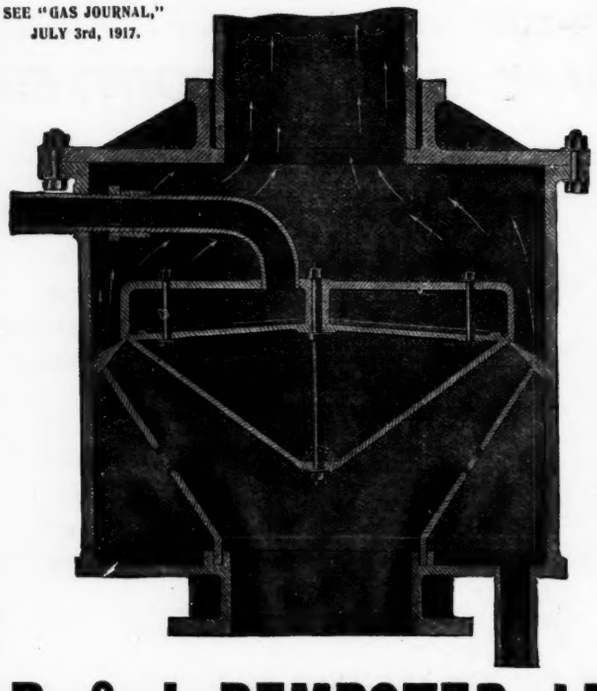

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Coatbridge Gas Company.—The Directors of the Coatbridge Gas Company report that for the year ended June 30 the gross revenue from gas, residual products, &c., amounted to £65,681. They recommend the payment of dividends at the rate of 9 p.ct. per annum on the original stock and £6 6s. p.ct. per annum on the three issues of £10 shares, less tax.

Public Lighting of Thurles.—The Thurles (co. Tipperary) Gas Company wrote to the Urban Council that, owing to the uncertainty of supplies and of coal prices and cost of labour, they could not see their way to tender for the lighting of the street lamps next season, but would supply gas to the lamps at the current prices of gas from time to time. The Council took no action.

The Coal Question at Marsden.—At a meeting of the Marsden District Council last Thursday, objection was taken to a minute instructing the Gas Engineer to resume normal supplies if the stock of coal became equal to three weeks' supply, and to stop motive power when the supply is down to eight days. It was held that notice ought to be given, and that there had been much inconvenience lately. The Chairman referred to unfulfilled promises of coal, and said it was difficult to give notice in present circumstances. When he telephoned to the Coal Controller's department, he had been told that they knew their business, and did not want any criticism. The minute was referred back.

The Sad Plight of Wombwell.—The following statement with regard to Wombwell's predicament appeared in the "Sheffield Daily Telegraph" last Friday: The shortage of fuel at Wombwell is giving the authorities grave concern; and the position is likely ere long to be felt very acutely. The Council have decided to shut-down completely the public baths for at least a week; and the supply of fuel for the gas-works has been exhausted. There will be no more gas for lighting, heating, or power purposes until further supplies of coal are to hand. Not the least alarming feature of the situation is that it is stated that the supply of coal for pumping the public water supply will be exhausted in a few days' time.

Grantham Gas Company.—The report of the Directors which was adopted at the half-yearly meeting of the Grantham Gas Company stated that the unforeseen great increase in the scale of wages, together with the exceptionally high price of coal and all other materials used in the manufacture and distribution of gas, coupled with the substantial decrease in the quantity of gas consumed, owing to the restrictions of the Coal Controller, had made it impossible to work the business at a profit. The loss on the six months had been £1285; but as a balance of £5082 was brought in at the beginning of the half year, the Directors had still available for payment of a dividend from that account the sum of £1959; and out of this they recommended a dividend of 5 p.ct. per annum. The Directors felt that they had no alternative but to give notice that from the end of the ensuing quarter the price of gas will be increased to 5s. per 1000 c.ft.

The Suggested Inquiry at Burnley.—The Burnley Town Council recently passed the following resolution: "That an expert gas engineer be engaged by the Council to examine into the working of the gas undertaking and to report to the Council thereon." At their next meeting, the Gas Committee considered this resolution, and passed another asking the General Purposes Committee to relieve them from the duty of giving effect to the Council's resolution.

Higher Prices at Wigan.—At the monthly meeting of the Wigan Town Council, Mr. Pagett, in moving the adoption of the Gas Committee's minutes, said there was a total estimated deficiency on the gas undertaking of £10,820. It had been resolved that the price of coke should be increased from 30s. to 35s. 10d. a ton; and this would contribute £3785. The Committee now proposed to increase the price of gas 8d. per 1000 c.ft., making it 5s. 8d. This would necessitate a resolution asking for power. The advance would realize £7200; so that there would be just enough to meet the deficiency. The resolution was adopted.

Effect of Sea Freight on Coal Prices.—A decision of the Littlehampton Gas Company to increase the price of gas 2s. (to 7s. 6d.) per 1000 c.ft., is attributed to the recent order of the Coal Controller compelling gas companies in the South of England to obtain their supplies of coal by water. It was mentioned at the meeting of the Directors at which the decision to raise the price was reached, that the all-in cost of coal at the Littlehampton works under the new arrangement will be 59s. 10½d. per ton, as against 37s. 11d. hitherto. Of this extra cost 6s. is due to the rise in coal generally, but 25s. of the total is required for freightage.

Newport (Mon.) Gas Company.—Presiding at the half-yearly meeting, Lieut.-Col. J. C. Rennie Brewer, J.P., said that since their last gathering they had suffered a great loss in the death of Alderman Thomas Canning, who was with the Company for 45 years, and during the last six years was a member of the Board. He proposed that the meeting express its deep sympathy with the deceased's relatives; and this was carried. Moving the adoption of the report and accounts, the Chairman said the Directors had, on this occasion, the duty of presenting a statement of a different character from that which had been usual at their meetings. The balance-sheet revealed increased sales to the extent of 5¾ million c.ft. of gas—an increase of 2 32 p.ct. over the corresponding period of last year; and there was an improvement in the sale of residuals to the extent of £5454. On the other hand, the increased costs of manufacture alone were £9118. The balance to be carried to profit and loss was £5888, which, after paying interest on debenture stock, left £4128. This would be inadequate to pay the usual 5 p.ct. dividend on the consolidated stock. The Directors, after much consideration, had decided to withdraw a further sum of £1500 from the reserve fund account; and, with this transfer, to pay a reduced dividend of 4 p.ct. per annum for the half year. Such a course had not hitherto been found necessary in the whole history of the Company.

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Singers and Coke-Fires.

Writing to "The Times," Prof. A. Vernon Harcourt says a musical correspondent has mentioned that he can never sing in a room with a coke-fire; and the Professor proceeds to explain what causes the "ill-repute" of coke-fires, how far it is deserved, and how the evil may be remedied. He says: Fire gases, if I may use this shorter name for the gaseous products of combustion and the nitrogen and air which accompany them, diffuse from the face of an open fire into the air of a room to an extent which is immaterial when there is a sufficient current of air through the fire, and above the fire, and into the chimney. The rate of this current depends chiefly on the temperature of the column of gas in the chimney, which is generally higher with the flame from coal than with glowing coke, and on the specific gravity of the fire gases, which is less when coal is burnt, because of the larger proportion of steam. From these causes the in-draught of air may be sufficient with some grates and chimneys, when coal is burnt, but not with coke—indeed, there may be an actual down-draught—and in these cases coke is naturally condemned. But sometimes the ill-repute may be undeserved. If a coal-fire "smokes," there can be no mistake as to the down-draught, and a remedy is applied, perhaps by some form of cowl, or by the simple plan of opening a window towards the wind and closing those on the opposite side. The fire gases from coke carry no suspended soot, and are only smelt or tasted; and they are supposed unjustly to have some harmful ingredient which is absent from the fire gases of coal. By lessening the space over the top of the fire, the surface from which diffusion takes place is diminished, and the draught through the fire is increased. In the grate of which you allowed me to give a brief description [*ante*, p. 300], this can be done by closing one or more of the little pairs of doors above the fire. An architect's drawing from which any competent builder could construct and set up one of these grates can be had from Mr. Moody, John Street, Ryde.

An Expert to Advise at Haworth.—The Haworth (Yorkshire) District Council last week considered a recommendation that they should call in an expert to advise and report on the gas undertaking. The Chairman said this arose out of a desire by the Gas Committee to be put in touch with the most modern methods of gas making. Though they had one of the best works in the country, they were not so conceited as to think there was nothing to be learned. The Council approved the recommendation, after some criticism.

Gas and Electricity Curtailed at Honley.—A special emergency meeting of the Honley (near Huddersfield) District Council learned from the Gas Manager that there was only fourteen days' coal supply in hand; and that the position was much the same in regard to electricity. It was decided that, until further notice, both gas and electricity should be cut off to all classes of consumers from 1 p.m. to 7 p.m. and from 10 p.m. to 6 a.m., with power to the Chairman to vary the curtailment in the event of further coal becoming available.

Stafford Gas Charges.—The Stafford Town Council have considered a recommendation from the Gas Committee, to the effect that after the September quarter the price of gas should be increased; the proposed new rates ranging from 4s. 6d. per 1000 c.ft. for any quantity up to 20,000 c.ft. per quarter, to 3s. 3d. for all quantities exceeding 3,000,000 c.ft. per quarter—the charges for slot-meters to be raised proportionately, the hire charges for gas-cookers and gas-fires to be doubled, and the cost of public lighting to be advanced. This, it was pointed out, was an all-round increase on the gas prices of 6d. per 1000 c.ft. There was considerable opposition, it being contended that a 4d. increase would be sufficient. Ultimately, by fourteen votes to eleven, the recommendations were referred back to the Committee.

Croydon Co-Partnership Report.—In presenting an abstract of the co-partners' accounts made up to March 31 last, the Co-Partnership Committee of the Croydon Gas Company (of which Mr. Charles Hussey is Chairman) say the bonus has been calculated at the rate of 4 p.ct. Up to March 31, 1919, from the inception of the scheme, 1056 co-partnership agreements have been entered into, and 458 have terminated, leaving 598 agreements in force. Of these 598 co-partners, 64 are now serving in H.M. forces; but the Directors have decided that bonuses shall continue to be credited to the accounts as if they were still working for the Company. They are relieved during their period of war service from payment of the subscriptions to which they would be ordinarily liable to the workmen's sick and burial fund and the pension fund, though their membership of these, with the benefits accruing therefrom, is unaffected. During the 10¼ years the scheme has been in operation, the bonus (covering 10¾ years) has amounted to £21,514, and the savings to £14,081. The total holdings in the Company's stocks acquired to date by co-partners through the scheme are £22,040.

An Explanation at Bury.—At a meeting of the Bury (Lancs.) Town Council last Thursday, Alderman Ashworth inquired how it had come about that in former years they had congratulated themselves as a community on being in a position to produce gas at a lower cost than most of their neighbours, they had now got to the highest possible charge. For what reason, he asked, was there such a change. Alderman Samuel Kay (the Chairman of the Gas Committee), replying to the question, said they had not, as had been done in many places, installed vertical retorts; and now, with the changed circumstances, those with vertical retorts could make gas more cheaply. The Gas Committee were going to try to remedy this as soon as possible. There were many reasons for the present position. Difficulties had to be contended with, there were increased wages, and the coal situation; but when they had the vertical retort system installed at the gas-works, he thought they would be able to make cheaper gas. He agreed that it was a big jump from the pre-war 1s. 10d. or 1s. 11d. per 1000 c.ft. to the maximum of 5s., which the Committee were now proposing. Eventually the Council accepted the Committee's recommendation to increase the price; and they also agreed to application being made temporarily to exceed the maximum charges by 50 p.ct.

SAWER & PURVES,

THE POSITIVE DRY PREPAYMENT METER

MANCHESTER & NOTTINGHAM.

Increased Costs at Todmorden.—The annual report of the Todmorden Corporation Gas Department shows that the extra 6s. per ton on coal will add £4000 per annum to the bill; and wages increases have added a similar figure to labour costs during the past year, as compared with the year before the war. Further increases of wages recently granted will cost an extra £1000.

Littleborough Gas Company.—The balance-sheet of the Littleborough Gas Company for the past half year was adopted at a meeting of shareholders on the 31st ult.—Mr. J. C. Hudson presiding. The sales of gas for the six months amounted to £6783, compared with £6026 in the corresponding period of last year; and the profit to £1159, against £1201. The sum available for distribution was £4097; and a dividend of 10 p.ct. per annum, less income-tax, was sanctioned.

Ashton-in-Makerfield Gas-Works Extensions.—At the last monthly meeting of the Ashton-in-Makerfield District Council, it was ordered that the wages of the gas workers be increased in accordance with the recent award; and it was decided to increase the price of gas to 6s. 3d. per 1000 c.ft. from Sept. 20. It was resolved that Dempster-Toogood plant be adopted for the proposed gas-works extensions, and that application be made to the Local Government Board for borrowing powers to the extent of £35,000 for the installation of vertical retorts and extensions, and £16,000 for a gasholder tank.

Gas-Works Estimates at Gainsborough.—The gas-works estimates for the ensuing year which were recently submitted to the Gainsborough Urban District Council showed a total expenditure (including £13,650 for 8000 tons of coal, £6000 for wages, £2000 for rates and taxes, and a balance to cover last year's loss) of £30,470. Mr. Spencer Watson said last year there was a net loss of £2540; and the Gas Committee, by proposing to raise the price of gas to 7s. per 1000 c.ft. were wishful of wiping-off this loss. On a vote being taken, there was a large majority in favour of the Committee's recommendation to increase the price.

Coal Supply to the Furness District.—The Ulverston Urban District Council, at their monthly meeting, decided, owing to the increased cost of coal, to raise the price of gas from 4s. 5d. to 5s. per 1000 c.ft. from Oct. 1. Mr. Warhurst stated that the enhanced cost of coal would mean to the Gas and Water Committee for the year ending March 31 next an increased expenditure of £1500. It was resolved to secure a united application from the whole of the Furness district and the area up to Kendal to the Coal Controller, to allow supplies of coal to be again obtained from the collieries of Lancashire and Yorkshire, instead of from Northumberland and Durham, which had increased the railway carriage from 3s. 6d. to 4s. per ton.

Newcastle (Staffs.) Gas-Works Report.—The annual report of the Newcastle (Staffs.) Gas-Works shows a net balance on revenue account of £65. The past year has been one of the best known at the gas-works, despite all the difficulties, and the fact that coal has been exceedingly hard to obtain. Though there was a decrease of £1845 in the gross profits as compared with the previous year, the total income from gas was £519 more. The revenue from the sale of residuals also increased by £847. But while the income was £1366 more, the increased expenditure amounted to £3231. Considering that the price of gas had not been raised since 1917, and that the Committee had been faced with three increases of wages to workmen, as well as with the advanced cost of coal, the results were regarded as very satisfactory.

Directory of Joint Standing Industrial Councils.—A directory has been issued by the Ministry of Labour of Joint Standing Industrial Councils, Interim Industrial Reconstruction Committees, and Trade Boards. It has been prepared primarily for the use of the members of these bodies and of Government Departments. Under the headings of the different industries concerned, the employers' representatives and the workpeople's representatives are set out; and, in order to facilitate reference, an index of members has been added. It was mentioned in last week's "JOURNAL" that the estimated number of workpeople employed in the gas industry represented by a Joint Industrial Council is 94,000, and in the electricity supply industry 29,000. The Interim Industrial Reconstruction Committee for the gas mantle industry represents 3000 workpeople.

Gas Pressure at Aberdeen.—Experiments have been made by Mr. S. Milne, Gas Manager at Aberdeen, as to the cause of defective pressure. He points out that since the use of rich cannel coal has been abandoned, a good deal of trouble has been experienced, owing to the naphthalene in the gas becoming deposited in a solid state in the distributing mains, due to lack of sufficient oily vapours accompanying the gas, and so keeping the naphthalene in suspension right up to the burner. The trouble was emphasized during the four years of war, when the benzol and toluol were being washed-out of the gas for high explosives. Mr. Milne is satisfied with both the vaporizing and spraying methods of dealing with the oils—the latter being the more effective. The Gas Committee have approved of the obtaining of a steam-driven reciprocating compressor and a patent sight-feed oil-sprayer from the Bryan-Donkin Company, of Chesterfield.

Gas Matters at Doncaster.—Moving the adoption of the Gas Committee's minutes by the Doncaster Town Council, Mr. Morris pointed out that they recommended that the price of gas for power and for industrial purposes be increased from 3s. 9d. to 4s. per 1000 c.ft., and for lighting and other purposes from 4s. to 4s. 6d. He said that the increase in the price of coal by 6s. a ton would cost the Corporation £7760 a year. By increasing the price of coke 6s. per ton, they reduced the loss by £2200, which reduced the Committee's additional liabilities this year, as compared with last year, to £5500. The increase of 6s. per ton on the cost of coal was equal to 7½d. per 1000 c.ft. increase in the cost of gas, which was reduced 2d. by the increased price of coke. Taking into consideration the time that must elapse before these increased prices for gas could come into operation, the Corporation were only asking to recoup themselves for their losses. The Gas Committee had now in hand 1200 tons of coal, or sufficient to last them three weeks. They proposed to conserve the supply of gas as far as possible by cutting down the lighting wherever practicable. Unless the miners' strike was over, they would have to abandon the street lighting entirely at the end of the week. The minutes were approved.

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STOCK MARKET REPORT.

The Stock Exchange reopened last week on Tuesday (after the August Bank Holiday) for a brief four days of work. Business continued of very much the same character as the week before. All the old sinister factors remained in full operation; the general condition of markets was dull and uninteresting; while the volume of transactions was of the most meagre proportions. This must, of course, be expected at the annual August exodus; and according to all accounts, the rush to get away from London this year exceeds all former records. The prevailing tone in most leading departments was weak; but at the close it was rather better than the worst of the week.

In the gilt-edged market, Home Government issues were not strong. Consols at one time were down to 50⅞; but they were a fraction better on Friday. The 5 p.ct. Loan seesawed up and down—finally touching the poor price of 93⅞. Bonds were down, but made a slight recovery later. Indians also fell. Home Rails had but a dull time, from which the open stocks amended somewhat; but prior charges mostly remained friendless. Canadians and Argentines were both weak.

The Foreign market showed much weakness. The persistent fall in the exchange value of the franc was fatal to French Loans; and Russians were swept down by the tide of affairs there. Other weak lines were Italian and Chinese.

Among the Miscellaneous, Rubbers were firmer than they have ruled for some time past; but the chief attraction was in Oils, which were very strong and active, despite some amount of profit snatching.

Business in the Gas market fell as nearly to stagnation as is possible to imagine. Only seven undertakings were dealt in at all; and most issues had but one transaction—or, at the most, a couple. There was hardly enough to produce any movement; and languid inactivity prevailed from start to finish. The only variations in quotation were a fall of 1 each in the ordinary stocks of Gas Light and Coke and South Metropolitan.

Bargains done for cash during the week were as follows: On Tuesday, Gas Light Ordinary 51¼, 51⅜, 52; Imperial Continental 126, 126⅛, 126⅜, ditto debenture 80, 80⅛; South Metropolitan 53. On Wednesday, Brentford A 60; Buenos Aires debenture 50¾; Gas Light Ordinary, 52½; Imperial Continental 126, 126⅛, 126⅜, 127; Primitiva preference 65s.; South Metropolitan 52½, 53, 53½, ditto preference, 94½. On Thursday, Brentford A 62; Cape Town preference 7⅛; Gas Light Ordinary, 51¼, 51⅜, 52; Imperial Continental 125, 126, 126⅛, 126⅜, 127, ditto debenture 79½, 80; Brighton and Hove 5 p.ct. debenture 80. On Friday, Gas Light Ordinary 51, 51⅛, 52, ditto debenture 53; Hong Kong and China 8 7/16, 8½; Imperial Continental 125¼, 126½, ditto debenture 80; Primitiva 32s. 6d.; South Metropolitan 52, 52⅞, 53; Southgate 5 p.ct. preference 75; Brighton and Hove 5 p.ct. debenture 81.

In the Money Market, rates fluctuated rather sharply—opening easy; then hardening in response to demands; and ultimately relaxing again before the close. The Bank rate is 5 p ct. as fixed on April 5, 1917.

The Directors of the Durham City Gas Company have given notice that, owing to the heavy increase in the cost of coals, wages, &c., they have been compelled to reduce dividends for the past half year to 3¾ p.ct. on the original and 2⅝ p.ct. on the additional shares.

ANTE-WAR PRICES AND DIVIDENDS, LATEST DIVIDENDS, AND LAST WEEK'S BARGAINS.

Issue. £	Share	When ex-Dividend.	Ante-War Dividend & Bonus p.c.	Last Dividend.	NAME.	Closing Prices July 30, 1914.	Present Prices.	Lowest and Highest Prices of Bargains.
183,049	Stk.	July 31	4	4%	Aldershot 4 p.c. Pref.	..	60–65*	..
1,551,868	,,	April 8	2½	2⅞%	Alliance & Dublin Ord.	59–64	45–55	..
874,000	,,	July 11	4	4%	Do. 4 p.c. Deb.	76–79	60–62	..
280,000	5	April 29	7½	8%	Bombay, Ltd.	5⅞–6⅜	5⅞–6¼	..
50,000	10	Feb. 26	16	12%	Bournemouth Gas and Water — 10 p.c.	29–30	19¼–20½	..
988,110	10	,,	7	7%	Bournemouth Gas and Water — B 7 p.c.	15–15½	10½–11⅛	..
115,000	10	,,	6	6/-	Bournemouth Gas and Water — Pref. 6 p.c.	13¾–14	9½–10	..
159,740	—	June 27	—	4%	Bournemouth Gas and Water — 4 p.c. Deb.	..	35–37	..
993,045	Stk.	July 11	14	37/-	Brentford A Consolid.	261–266	60–65	60–62
784,220	,,	,,	11	31/8	Do. B New	204–209	55–60	..
55 000	,,	,,	5	5%	Do. 5 p.c. Pref.	109–111	76–78	..
221,400	,,	June 11	4	4%	Do. 4 p.c. Deb.	91–93	64–66	..
214,775	,,	Feb. 26	11	7½%	Brighton & Hove Orig.	208–213	137–142	..
244,200	,,	,,	8	5½%	Do. A Ord. Stk.	154–159	94–99	..
933,500	Stk.	—	5	5%	Bristol 5 p.c. max.	..	..	..
580,000	20	Mar. 26	12½	10%	British	44–45	30–31	..
120,000	Stk.	June 27	4	4%	Do. 4 p.c. Deb. Stk.	88–90	63–65	..
245,771	,,	,,	4	4%	Buenos Aires 4 p.c. Deb.	86–87	50–53	50⅜
100,000	10	—	—	—	Cape Town & Dis., Ltd.	1½–2½	6½–6⅞	..
100,000	10	—	—	4½%	Do. 4½ p.c. Pref.	4–6	7–7½	7⅛
100,000	Stk.	June 27	4½	4½%	Do. 4½ p.c. Deb. Stk.	70–75	61–66	..
157,150	,,	Feb. 26	5	5%	Chester 5 p.c. Ord.	108–110	..	..
1,518,280	,,	Feb. 12	5/9/4	30/-	Commercial 4 p.c. Stk.	106–108	60–63	..
560,000	,,	,,	5⅓	26/8	Do. 5½ p.c. do.	103–105	58–61	..
475,000	,,	June 11	8	8%	Do. 3 p.c. Deb. Stk.	69½–71½	50–52	..
800,000	,,	,,	4	—	Continental Union Ltd.	76–79	48–48	..
200,000	,,	,,	7	—	Do. 7 p.c. Pref.	115–118	65–70	..
51,600	Stk.	Aug. 29	14½	12½%	Croydon A 10 p.c.	..	155–165	..
278,400	—	,,	11½	9½%	Croydon B and C 7 p.c.	..	130–135	..
493,270	Stk.	—	6	6½%	Derby Con. Stk.	128–125	..	..
55,000	,,	—	4	4%	Do. Deb. Stk.	102–104	..	..
1,002,180	10	July 30	10	5/0	European, Ltd.	17½–18	14½–15⅜*	..
16,298,975	Stk.	,,	4/17/4	30/-	Gas Light and Coke — 4 p.c. Ord.	99–102	50–52⅝	51–52½
2,600,000	,,	,,	8½	26/8	Gas Light and Coke — 8½ p.c. max.	76–79	42–50*	..
4,062,285	,,	,,	4	4%	Gas Light and Coke — 4 p.c. Con. Pref.	96–99	66–68*	..
4,674,850	,,	June 11	8	8%	Gas Light and Coke — 8 p.c. Con. Deb.	72½–74½	52–55	53
130,000	,,	,,	10	10%	Gas Light and Coke — 10 p.c. Bonds	..	..	..
82,500	,,	Mar. 12	5	4½%	Hastings & St. L. 5 p.c.	..	59–64	..
258,740	,,	—	3½	2⅞%	Do. 3½ p.c	37–39	44–49	..
70,000	10	April 29	11	7%	Hongkong & China, Ltd.	16½–16⅝	7 7/16–8⅛	8 7/16–8⅛
88,600	Stk.	Sept. 12	9	8½%	Hornsey 7 p.c.	..	115–120	..
181,000	,,	Mar. 12	7½	5⅞%	Ilford A and C.	151–154	90–95	..
65.780	,,	,,	6⅔	4½%	Do. B	115–118	69–74	..
65,500	,,	June 27	4	4%	Do. 4 p.c. Deb.	92–94	61–64	..
4,940,000	,,	May 14	9	4½%	Imperial Continental	150–160	125–130	125–127
1,936,000	,,	Feb. 12	8½	8½%	Do. 8½ p.c. Deb. Red.	84–86	79 81	79½–80½
285,242	,,	Mar. 12	6½	6½%	Lea Bridge Ord. 5 p.c.	119–121	90–95	..
2,498,905	,,	Feb. 26	10	42/6	Liverpool 5 p.c. Ord. — A	211–218	..	..
					Liverpool 5 p.c. Ord. — B	146–148		
306,088	,,	June 26	4	4%	Do. 4 p.c. Pr. Deb. Stk.	..	..	..
165,736	,,	Feb. 17	7/5/6	33⅓%	Maidstone 5 p.c.	..	58–63	..
75,000	5	June 11	6	5%	Malta & Mediterranean	4½–4¾	3½–3¾	..
250,000	100	April 1	4½	4½%	Met. of Melbourne 4½ p.c. Deb.	99–101	91–98	..
541,920	20	May 29	4	5%	Monte Video, Ltd.	11½–12	13–14	..
1,875,822	Stk.	July 30	4½	8½%	Newcastle&Gatsh'dCon.	98½–99½	64–65*	..
529,705	,,	June 27	8½	8½%	Do. 3½ p.c. Deb.	82–83	57–58	..
15.000	10	Mar. 18	—	11%	North Middlesex 10 p.c.	..	13½ 14	..
55,940	10	,,	7/14/0	7%	,, ,, 7 p.c.	14–15	9½–9⅞	..
300,000	Stk.	May 14	8	8%	Oriental, Ltd.	117–122	108–116	..
60,000	5	Mar. 26	10	1/-	Ottoman, Ltd.	7½–7⅞	4⅜–5½	..
60,000	50	Feb. 26	18	7½%	Portsea, Island B	198–181	76–81	..
100,000	50	,,	12	6½%	Do. C	118–121	58–63	..
249,980	5	April 29	8	—	Primitiva Ord.	5¼–6	1½–2	32/6
499,950	5	June 26	5	—	Do. 5 p.c. Pref.	4¼–5	3½–3⅝	65/-
531,600	100	June 2	4	4%	Do. 4 p.c. Deb.	91–98	71–78	..
600,000	Stk.	July 30	4	4%	Do. ,, ,, 1911	..	49–52*	..
346,198	,,	June 27	4	4%	River Plate 4 p.c. Deb.	86–87	49–52	..
150,000	10	May 14	6	6/-	San Paulo 6 p.c. Pref.	10½–11	7½–8	..
125,000	50	July 2	5	5%	San Paulo 5 p.c. Deb.	47–49	40–42	..
135,000	Stk.	Mar. 12	10	5%	Sheffield A	228–234	88–87	..
209,984	,,	,,	10	5%	Do. B	222–224	88–87	..
528,500	,,	,,	10	4⅔%	Do. C	220–222	73–76	..
133,201	Stk.	Sept. 12	4	4%	Shrewsbury 5 p.c.	..	..	..
90,000	10	June 27	9	10%	South African	10½–11½	12½–13½	..
6,609,895	Stk.	Feb. 10	5/4/0	30/-	South Met. 4 p.c. Ord.	111–113	52–55	52–53½
250,000	,,	July 11	—	5%	Do. Pref.	..	94–96	94½
1,895,445	,,	,,	8	8%	Do. 3 p.c. Deb.	73½–74½	52–54	..
224,820	,,	Feb. 26	8½	5⅔%	South Shields Con. Stk.	157–159	99–101	..
962,795	,,	,,	8	8½%	S'th Suburb'n Ord. 5 p.c.	114–116	76–79	..
187,558	Stk.	June 27	5	5%	Do. 5 p.c. Deb. Stk.	116–118	88–91	..
647,740	,,	May 14	7½	5%	Southampton Ord.	99–102	67–69	..
121,275	,,	June 27	4	4%	Do. 4 p.c. Deb. Stk.	..	63–65	..
190,000	,,	Feb. 12		4⅔%	Tottenham A 5 p.c.	135–138	85–90	..
762,276	,,	,,	6	3%	Tottenham District B 3½ p.c.	115–117	70–65	..
181,355	,,	June 26	4	4%	Tottenham District 4 p.c. Deb.	87–89	64–66	..
182,380	10	Dec. 30	5	—	Tuscan, Ltd.	5–6	1–2	..
149,900	10	July 1	5	5%	Do. 5 p.c. Deb. Red.	93–95	45–50	..
236,476	Stk.	Mar. 12	5	5%	Tynemouth 5 p.c. max.	103½–109	83–85	..
					Wandsworth, Wimbledon, and Epsom—			
80,000	,,	Feb. 26	3⅜	55/-	Wandsworth A 5 p.c.	151–156	88–93	..
255,636	,,	,,	6¼	40/-	Do. B 3½ p.c.	129–134	65–70	..
108,075	,,	,,	—	33/6	Do. C	..	68–73	..
140,865	,,	,,	—	33/6	New Ordinary	..	68–73	..
852,000	,,	,,	6⅔	33/9	Wimbledon 5 p.c.	117–122	63–73	..
98,000	,,	,,	6⅜	40/-	Epsom 5 p.c.	121–126	70–75	..
88,416	,,	June 27	8	8%	8 p.c. Deb. Stk.	68–69	49–51	..

* Ex Div.

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